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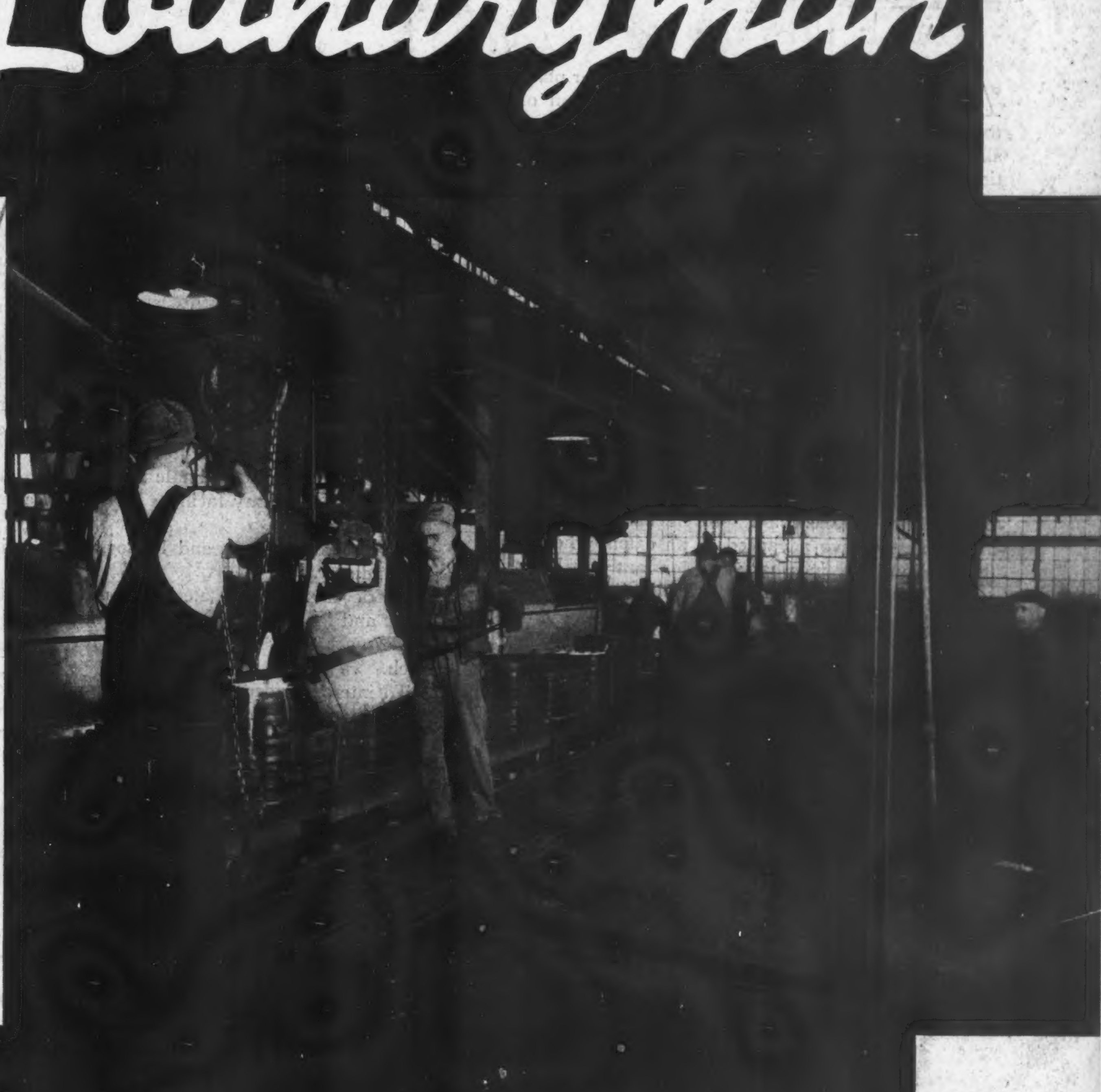
AMERICAN FOUNDRYMEN'S ASSOCIATION
FOUNDED 1896

# American Foundryman



April
1945

# *Improvement of "Craft" Motivates Technical Development Program*

ANY discussion of the ambitions, hopes, or plans for the Technical Development Program of the American Foundrymen's Association must first of all recall the purposes and objectives of the Association as conceived and set forth by its founders, and which were stated in the by-laws almost 50 years ago, namely:

1. "To promote the art and sciences applicable to metal castings manufacture."

2. "To improve the methods of production and the quality of castings."

It will be noted that at the outset, the founders charged the American Foundrymen's Association with two obligations—"To promote and to improve."

Since its origin, the membership of the American Foundrymen's Association has vigorously and unselfishly pursued these purposes to the end that today the casting of metals is almost a definite art and nearly an exact science. Improvements of methods and processes have advanced to an extent whereby the quality of castings has risen constantly to levels which were once thought impossible.

The business of "Cast Metals" has become one of the most important industries of the world. The American Foundrymen's Association always has been, since its origin, and is today even more than ever, a Technical Association. Starting as a dream effort of the founders, it today has some 7,300 members, and is a great pulsating organization imbued with a mutual desire to improve its "Craft" and an intent to make available to the world the results of its scientific discoveries and mechanical improvements.

Within this 50-year period, literally thousands of men have voluntarily and unselfishly contributed of their time and effort for the betterment of their industry and its product, with the result that within the printed record of the Association are recorded these activities which not only tell the stories of progress, but outline the procedure and processes by which this progress has been made.

To have gathered and recorded this vast amount of information and research record is a worthy effort, but to have made these studies and to have recorded the results does not of itself accomplish the full purposes of the founders. A man who reads and reads and reads and yet does not speak contributes nothing to his fellowmen, for he is like a plowman who plows and plows and plows and does not sow the seed.

So, in order that these full purposes of the Association may be accomplished, the Board of Directors has very wisely created the Technical Development Program, whose obligation it shall be—

1. To disseminate this information to all men in the industry by publishing books and literature in readable form, by collecting, reviewing, summarizing and correlating published and unpublished data on selected outstanding foundry problems.
2. To promote and coordinate research activities.
3. To broaden library facilities for reference and abstract purposes.
4. To provide abstract and bibliographic advice for the industry.
5. To develop lecture material for use in chapter meetings and for engineering and student groups.
6. To suggest new technical subjects for studies in research.
7. To interest students, both high school and college, and returning service men in order to attract new and better personnel to the industry.
8. To interest engineers, designers, and fabricators in the superior values of cast structures.

This is a large and long time program which calls for the best efforts of the men both within and outside our Association, and is very worthy of your cooperation.

S. V. Wood

S. V. WOOD, *Chairman,*
A.F.A. Technical Development Program.

# American Foundryman

## APRIL 1945

VOLUME VII
NUMBER 4

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*The American Foundrymen's Association is not responsible for statements or opinions advanced by authors of papers printed in its publications.*

Published by the American Foundrymen's Association, Inc., 222 West Adams St., Chicago, Ill., for the purpose of presenting Association and Chapter activities. Published monthly. Subscription price, to members, $1.00 per year; to non-members, $1.50 per year. Single copies, 20c.

Entered as second class matter July 22, 1938, at the post office at Chicago, Illinois, under the Act of March 3, 1879

# REVISED DUES STRUCTURE

## *Effective July 1st Will Finance*

# EXTENSIVE POST-WAR PROGRAM

ACTIONS taken by the A.F.A. Board of Directors at the mid-year Board meeting in Chicago, January 16, are of such far-reaching scope as to profoundly affect the service rendered by A.F.A. for many years to come. One of those actions was of an emergency character, as described in the March issue of AMERICAN FOUNDRYMAN, and has been well received throughout the industry.

In order to finance an extended and progressive plan of activities into the post-war period, the Board also voted to increase Company and Sustaining member dues, effective July 1st, 1945, without changing in any way the dues for Personal memberships. Thus, on July 1st the annual dues of Company members will become $50.00; the annual dues of Sustaining members, $100.00 minimum.

### Service Demands Far Greater

The decision to increase dues was made only after consideration of the question by every Board of Directors serving during the past five years. It was voted solely to provide a financial stability that would permit increasing A.F.A. services for a greatly increased membership.

No change in member dues structure has occurred since 1938, when the membership stood at 2,953, with 14 chapters in operation. Today the membership exceeds 7,600, and the 30 active chapters of A.F.A., in every section of the country, have tremendously increased the demands made on A.F.A. services and revenues. In spite of a 157 per cent increase in membership and 114 per cent increase in chapters, the National Office Staff has increased only 17 per cent in the past seven years.

### Exhaustive Study Made

In 1940 a proposal to increase dues was made before the Board, in recognition of the growing need for information by foundries entering upon wartime production under rigid specifications. This proposal was augmented by suggestions from several committees of foundrymen, pointing out the need for revenues adequate for the job at hand. In 1942 a fact-finding body was appointed by the Board to study the dues structure and make recommendations.

As a result of such preliminary studies, at the annual Board meeting in July, 1944, a directive was given the Executive Committee to pursue the matter further. The subject was considered from every angle and the views of the Executive Committee embodied in an 18-page report which was submitted to the January 16 meeting of the Directors, recommending the dues changes which the entire Board unanimously approved.

### The Industry's Opportunity

In its deliberations, the Directors believed that a great opportunity confronts the foundry industry in the years immediately ahead. War-expanded metalworking plants must have information that will enable them to meet the problems of reconversion quickly and to adapt their capacities to production of peacetime products.

While the economy of metal casting is well known, new materials and processes competitive with the foundry product will be brought aggressively to the attention of product designers. As a result, foundrymen will be able to retain their basic markets only by exercising the greatest skill and resourcefulness, with every attention to control of quality.

More thorough and widespread knowledge of design factors, physical metallurgy and quality control are essential if the foundries are to make the most of their opportunity to satisfy the demands of post-war industry.

Here is an opportunity that calls for realization and acceptance, on the part of foundry management, of

### NEW A.F.A. DUES STRUCTURE

For financing a program of expanded service to the industry, the A.F.A. Board of Directors has approved the following revised dues structure, to become effective as of July 1, 1945, at the beginning of the new fiscal year.

| *Present Dues* | *Class of Membership* | *Dues on July 1, 1945* |
|---|---|---|
| **$50.00 minimum** | **SUSTAINING** — For firms desiring to aid the Association's activities in more direct proportion to the benefits received. | **minimum $100.00** |
| **$25.00 annual** | **COMPANY** — Separate Company membership required for each separate plant of any one organization. | **annual $50.00** |
| **$15.00 annual** | **PERSONAL** — For individuals not connected with Sustaining or Company member plants. | **annual $15.00** |
| **$8.00 annual.** | **(Exception No. 1—Individuals connected with plants holding Company or Sustaining memberships)** | **annual $8.00** |
| **$8.00 annual.** | **(Exception No. 2—Individuals engaged solely in Educational work not directly related commercially to the manufacture or use of castings)** | **annual $8.00** |
| **$4.00 annual** | **STUDENT OR APPRENTICE** — Application for Student or Apprentice membership should be signed or verified by Instructor or Supervisor. | **annual $4.00** |

the great value in working together through such an organization as A.F.A. However, in order to perform the service expected of it, and which a technical society representing every branch of the industry should render, it must be soundly and adequately financed.

### Chapters Most Active

Since the first A.F.A. Chapter was established in 1934, a steadily increasing number of national activities have been carried on through the medium of these local groups. The energy and enthusiasm of Chapter officers has been an outstanding factor in building good will and prestige for the foundry industry in local areas, and in making their members more progress-minded. Any long-range program of A.F.A. activities must contemplate complete co-operation with the men of the local Chapters, and providing services that they can best utilize in their territorial efforts.

Many Chapters are working to obtain a more active interest in their affairs by foundry management, realizing that a considerable number of their Company and Sustaining members have taken little or no advantage of the Personal (Affiliate) membership privilege. Every foundry, no matter how small, has a certain number of "key men" who are responsible for the production and quality of castings, and it is to the interests of their firms that these key men have available to them full information on the latest and best developments in casting techniques.

### Continuity Assured

In July, 1944, the A.F.A. Board approved formation of the Technical Development Program for broadening and coordinating the technical activities of the Association. The Program sets up a special department charged with the responsibility for increasing the flow of needed technical information on foundry subjects. In the original announcement of the Program, there is this statement:

*"Establishment of an adequate working fund, through voluntary contributions by the industry, will provide the sound beginning needed for a strong Technical Development Program. Maintenance of that working fund through other sources of Association revenue should make unnecessary recurrent calls upon the industry as the work of the Program progresses."*

An initial working fund of $250,000 is now being sought for primary financing of the Program, and the response from all types of foundries has been most gratifying. Necessarily long-range in its major activities, the Program staff has already produced several notable additions to the literature of the industry.

The scope of activities and chart of organization of the Technical Development Program were published in the October, 1944, issue of AMERICAN FOUNDRYMAN. Operating under an annual budget approved by the A.F.A. Board, the value of the Program to the industry should be adequately provided for under the new dues structure.

### Post-War Objectives

Like the heads of many business concerns, the A.F.A. Directors have given serious thought to the services the Association can render a post-war foundry industry. It is realized that the post-war period will impose upon A.F.A. obligations in greater number and of greater reality, and that facilities must be assured for carrying out a program of long-range objectives.

Basically, every foundry executive and every phase of metal casting will be affected by the major objectives of an A.F.A. post-war program. Some of these objectives, considered by the Board in its revenue planning, are described here briefly.

***Objective: Sponsoring basic research on problems of interest to all branches of metal casting.***

A great deal of valuable foundry research has been performed by the several foundry trade associations . . . Steel Founders' Society of America, Malleable Founders' Society, Gray Iron Founders' Society and, more recently, the Nonferrous Founders' Society. Such investigations on specific metals, confined as it must be in each case by the specific trade interests of each group, will naturally be continued and expanded.

These activities do not and need not overlap the essentially basic work of A.F.A. Rather, they are a necessary corollary to the efforts of A.F.A., the one technical society serving the interests of all phases of metal casting. Many basic investigations can best be carried on under A.F.A. sponsorship, and obviously would avoid duplication of effort.

It should be stressed that the support of A.F.A. investigational work by the industry is in no way a duplication of the support given the research efforts of the trade groups. Each complements the other, and in many instances the basic findings of A.F.A. projects will facilitate and reduce the expense of research on specific metals problems.

***Objective: Stimulation of interest in Apprentice Training throughout the Foundry Industry.***

Not until the war's end can this objective be fully realized, yet it concerns one of the most important problems the industry must face in the immediate post-war future. Many foundry executives today are deeply concerned with the training of returned veterans and of those youths soon to enter industry. As one foundry superintendent, quoted elsewhere in this article, puts it: *". . . We must face the fact that the foundry industry has been very lax regarding the training of apprentice jobbing molders. You cannot teach a boy the trade on a molding machine . . ."*

Ever since its inception, A.F.A. has played a strong part in encouraging the adoption of apprentice training courses. As long ago as 1897, the A.F.A. Apprentice Training Committee offered a uniform apprentice plan to the industry, and for many years has sponsored annually national apprentice contests in molding and patternmaking. Until the war depleted the ranks of plant apprentices, thousands of young men entered these contests each year, improving their knowledge of foundry practice through the impetus of competitive efforts.

***Objective: Encouraging youths to consider foundry work as a livelihood.***

Last year A.F.A. created a new Board committee, the Committee on Youth Encouragement, in order to bring to young men of high school and even grade school age a greater appreciation of the opportunities available in the foundry. This is no short-time program; rather, it involves long-range planning of a public relations character that can be carried on only by an organization

representing all branches of the industry impartially.

Such a program includes careful planning and close and continuous cooperation with local educational authorities, vocational placement bureaus, chambers of commerce, parent-teacher organizations and other civic groups, as well as with the young men themselves. The field has hardly been scratched by the foundry industry, although many of the largest industrial corporations in America are devoting considerable thought to it. Several of our largest "captive" foundries have assured A.F.A. of their hearty cooperation and support, and some jobbing foundries also have expressed growing interest in this vitally important work.

***Objective: Stimulating the improvement of working conditions in the foundry so as to attract better types of workers.***

A great deal of publicity harmful to the foundry industry as a whole has emanated from high places during the past several war years, as all foundry executives are aware. It has contributed materially to manpower difficulties by influencing promising men to seek employment elsewhere, and has made many a foundry a prey to unauthorized and unnecessary demands.

For a number of years the A.F.A. Industrial Hygiene Codes Committees have sponsored codes of safe practice, housekeeping and sanitation which, if adopted generally, might materially have prevented many of today's unfounded attacks. These codes have all been prepared with an eye toward economy of installation as well as efficiency of operation, and are today recognized as fundamentals for improvement of working conditions. In many instances, their adoption has had a definite influence on insurance rates and state compensation factors.

It is an objective of your Association to continue its vigorous efforts for the improvement of working conditions in every foundry, in recognition of the old saying that "one rotten apple will spoil the entire barrel." For this aim, cooperation is essential.

***Objective: Cooperation with the faculties of engineering schools and colleges, for the improvement of foundry courses.***

Replies to a recent A.F.A. questionnaire, circulated among the deans of engineering of our foremost schools and colleges, indicate that the trend toward specialized education now is in reverse. Today the aim is to train men thoroughly in engineering fundamentals, but not to train foundry engineers.

Here is a great opportunity for the foundry industry to keep these schools informed of current foundry problems, work with them constantly for improvement of foundry courses, offer research problems which the schools can undertake, and provide inspiration to the faculties themselves in turning out the kind of men the foundries need. A.F.A. has carried on for a number of years a program of cooperation with engineering schools and colleges, and this work must be progressively expanded in the years just ahead.

***Objective: Stimulating the interest of engineering school and college students in the foundry business as a career.***

Where will the foundry industry obtain its future executive personnel? Few trained men are coming into the industry today, largely because of existing conditions.

Whether or not the foundries receive their just share of the engineering school graduates of tomorrow, depends greatly on the industry itself. For years, many industries have actively sought graduates of such schools, and the foundries must compete with every other industry for trained engineers, even though no line of engineering offers such opportunities as can be found in the foundry.

Visual educational material, scholarships, research fellowships, lectures by foundry authorities, chapter cooperation with student foundry groups, literature on foundry opportunities, summer-time employment of both students and engineering instructors, short courses for foundrymen in engineering schools, resumption of A.F.A. regional meetings . . . these are some of the many sug-

## A Foundry Superintendent Looks at His Industry and Its Opportunities

*The following is quoted from the March meeting announcement of the Southern California Chapter of A.F.A., attributed to B. G. Emmett, General Superintendent, Los Angeles Steel Castings Co., Los Angeles. It is reprinted here as the expression of one leading foundryman on the future of his industry.*

"During the past 20 years, the Foundry Industry, both ferrous and non-ferrous, has gone ahead by leaps and bounds. Metals have been greatly improved. Chemical analyses have been more closely controlled. Physical properties have in some instances been increased as much as 150 per cent. Heat treatment of castings has come into its own. Molding and coremaking by production methods such as squeezers, strippers, bumpers and rollover machines, core blowers, etc., have lowered the manhours per ton on production jobs.

"Non-destructive testing methods in the inspection department have done a great deal for us in proving to the engineer that castings, when properly made, are free of holes and cracks. Therefore, engineers are leaning more and more toward the use of castings in their designs.

"Sand control has done a great deal toward making castings clean and free from blows, dirt, etc., giving them a very good appearance. Heading and gating have been improved greatly; in fact, I venture to say that 20 years ago anyone who put a head on the bottom of a casting would have been considered crazy.

"In view of all the changes that have taken place in the past 20 years, any plant manager, superintendent or foreman who does not stay abreast of the times will be left by the wayside. Today a membership in the A.F.A. is a must for every successful foundryman.

"For our own security, we must face the fact that the Foundry Industry has been very lax regarding the training of apprentice jobbing molders. You cannot teach a boy the trade on a molding machine, and we of the A.F.A. had better get together, face the situation and do something about this matter, as our real jobbing mechanics are becoming scarcer every day. We must realize that this is impeding our own industry and correct the situation before it becomes tragically serious."

gested means of stimulating needed cooperation between the industry and the engineering schools. In the post-war program of A.F.A., such cooperation will receive major attention.

***Objective: Coordination of published information relative to cast metals, their production and quality control.***

Over the years, a vast amount of information has been published in books and in the industrial trade press on the cast metals. One of the main sources is the A.F.A. itself, whose annual bound volumes of *Transactions* have recorded practically every major advancement in foundry practice in a half century. To correlate, compile and make conveniently available to the industry this vast wealth of material is a tremendous task, but one that has long been needed.

A.F.A. has already made the beginnings in this monumental work, and its development and expansion waits only upon necessary staff and funds. The value of such data to private researchers and to foundry executives can hardly be estimated.

***Objective: Creation of a superior Foundry Library on all cast metals.***

This work is already proceeding under the newly established Technical Development Program of A.F.A. Several new and important books (notably *Cast Metals Handbook* and the 1944 *Sand Testing Handbook)* have already been added to the literature of the industry. As the Association's long-range program finds it possible to expand, additional volumes dealing with fundamental practice will be forthcoming.

***Objective: Strengthening the work of A.F.A. chapters, especially toward gaining greater foundry recognition locally and nationally.***

The thirty Chapters of A.F.A., comprising nearly 8,000 men active in improving themselves, their companies and their industry, can perform a great service on behalf of the industry by stimulating community good will for the foundries themselves. A few chapters have done yeoman service in this field, but much more remains to be done, under the active leadership of your national Association.

Obviously, such planning must be for the "long pull," because public relations work, even within a single community, can produce only relatively intangible results even over a considerable period of time. Cooperation and a continuous program are vital elements.

***Objective: Increasing and broadening foundry educational courses, for men now in the shops as well as for incoming workers.***

Many A.F.A. chapters have been stimulated to offer foundry lecture courses for the men of local plants, and such courses have proved of great value wherever given. Several chapters have conducted such courses on a four-year basis, with the subjects for each year progressively advanced.

To broaden the scope and number of such courses, and to reach a larger portion of the foundry personnel, is an important element of the A.F.A. post-war program. It involves selling foundry management on the value of a more broadly trained personnel. It includes, in some respects, the problem of the returned veteran, eager to learn more and advance himself. It concerns, also, the offering of courses for different levels of workers. In any long-range program, the educational course must be given full attention.

***Objective: Sponsoring means for presenting to the foundry industry the latest and best developments in equipment, materials and supplies.***

The A.F.A. Foundry Shows, held in conjunction with the annual Foundry Congress of the Association, have long performed an outstanding service for the industry. At these exhibits foundrymen have been made more conscious of the ways and means for increasing castings production, lowering costs, and improving the quality of cast structures. By improving their methods, many foundries have been able to meet the competition of substitute materials.

Recognizing the fact that post-war competition of engineering materials will be stronger than ever before, A.F.A. intends to resume the staging of Foundry Shows as soon as conditions permit. Even in this non-exhibit year, an unusual number of unsolicited requests for exhibit space were received prior to cancellation of the Detroit convention.

***Objective: Cooperation with other technical and engineering societies so as to keep the advantages of cast metals before the attention of engineers.***

A.F.A. maintains representation on committees of many technical societies, such as A.S.M.E., A.I.M.E., S.A.E., A.S.M., A.S.T.M., etc., so that castings receive full consideration in the preparation of handbooks, manuals, specifications and papers intended primarily for consumption by engineers. One erroneous or uninformed comment on an important property of cast metals can easily offset years of painstaking research. As the scope and membership of technical groups increases, they must be continually supplied with accurate, up-to-date information on the foundry product and its usefulness.

***Objective: Selling the engineering point of view to foundrymen, as well as the foundry's point of view to engineers.***

Since cast structures find their greatest usefulness as engineering materials, it is obvious that foundrymen and engineers should cooperate closely so that each understands the other's problems and purposes. Through interchange of speakers and literature, and joint foundry-engineering meetings, much can be done to establish common objectives. With many new materials available for the designing of post-war industrial products, it is essential that engineers be more familiar with the properties of cast metals, and production problems.

The A.F.A. *Cast Metals Handbook* was prepared primarily from the engineering point of view, in order to help bridge this gap. Several thousand copies have been distributed among designing and product engineers, and this excellent beginning must be followed up and augmented by the cooperative efforts of the entire foundry industry.

***Objective: Coordination of the efforts of A.F.A. and the various foundry trade associations on problems of mutual interest.***

Full recognition some day will be given the fact that there is a com-

plete community of interest between A.F.A. and the trade associations in that all *serve an industry concerned primarily with the engineering usefulness of cast structures,* regardless of the cast metal employed. A bad casting delivered can easily reflect on all castings and result in substitution of a part made by a competitive process. With greater realization of this truism by foundry executives, will come a more complete coordination of the activities of all societies serving the foundry field.

### All Basic Objectives

It should be pointed out that all of the above objectives are objectives that have guided A.F.A. activities over the past half century. They were incorporated in the Association's charter, drawn in 1897, "*. . . To promote the arts and sciences applicable to metal casting manufacture and to improve the methods of production and quality of castings . . .*" However, only through increased revenue can their full potentialities be developed to the point of greatest assistance to the foundry industry in meeting post-war competition and conditions.

In approving a new dues structure the A.F.A. Board of Directors, composed almost wholly of foundrymen, expressed complete confidence that the industry would evalute their action in terms of post-war foundry progress. The revisions have been further discussed with the boards of directors of practically every A.F.A. Chapter, and with individual foundry executives.

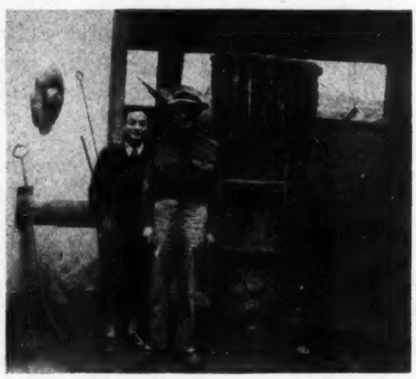
The complete assurance of cooperation with the new structure means that your Association will be able to enter a post-war period of greatest possible usefulness to the industry armed with the support of some 8,000 members and with adequate finances to do the job that must be done.

# CHINESE FOUNDRIES

## *Operate Amid Hardships Imposed by War*

WHILE on an inspection tour of plants operated by the National Resources Commission of the Chinese Government, E. K. Smith, Department of State, Washington, D. C., had an opportunity to observe at first hand war production work maintained under most severe hardship.

Mr. Smith is well known to Association members for his talks at chapter meetings and for his committee work in the gray iron and malleable fields. In a recent letter from him, which included the accompanying photograph, he describes some of the operating difficulties prevailing in Chinese foundry practice, and gives a pathetic glimpse of life in China:



E. K. Smith and a native helper.

"Enclosed is a snapshot of B. Hsu, a native Chinese cupola, and me. We were just starting on a rush job, and we used that contrivance to make some cupola malleable. The problem was typical of those one meets here. Melting equipment consisted of large and small cupolas, bessemer converter, and one large annealing oven for steel.

"All the pig iron was very high phosphorous, or high manganese, or both. There was little steel scrap and no malleable scrap available. We had no way of analyzing for carbon, and we worked without a pyrometer. Despite all this, we managed to get some good test sprues, and we are annealing the first castings in a coke-fired crucible by eye, while hoping for the best.

"Sand for the steel castings is crushed from quartzite rocks, and sifted by hand. It is impossible to get any heavy crushing equipment, and the amount of hand labor is appalling. We dug some river sand from the bank of the Chialing River, and we may be able to use this for steel castings.

"The workers are clever and willing, however, and they do a wonderful job with the crudest equipment. They read whatever is obtainable; that is, the supervisors do. Incidentally, my copy of the A.F.A. *Cast Metals Handbook* is in great demand.

"We have no compressed air, no gas, no oxy-acetylene torch or electric welding. Fins are chipped from steel castings by chisel, sand is removed by beating the casting with hammers, and risers are removed by drilling holes in a row, then hammering off the riser.

"Much of the foundry equipment used to be imported, and some of it came from what is now occupied, particularly the alloys. You can imagine what a hardship it is to make iron and steel with no nickel or chromium.

"Life is rather primitive in some ways and in some places, but every effort is exerted to make one comfortable. The water is undrinkable unless boiled, so everyone drinks tea. The worst things are the malarial and other diseases.

"One thing we get here that you in the U. S. fortunately have missed so far is to be awakened in the night, jump into our clothes, and spend hours in an air raid shelter. The surprising thing to me is to see mothers with assorted babies, old people and young getting in the shelters, all cheerful and without complaint. The Chinese can certainly 'take it'."

## Bulletin Describes Jobs Suited for Youngsters

THE U. S. Department of Labor Children's Bureau has just released their Bulletin No. 12—Advisory Standards for Foundries. This bulletin was prepared with the cooperation of representatives of the foundry industry and gives recommendations for jobs too hazardous and jobs relatively safe for 16 and 17-year-old workers in foundries. Members desiring copies can obtain them by writing to the U. S. Department of Labor, Children's Bureau, Washington, D. C., and asking for a copy of Bulletin No. 12—Advisory Standards for Foundries.

# Gating, Risering and Chilling of MAGNESIUM CASTINGS

***• The information, sketches and outlines under the title, "Gating, Risering and Chilling of Magnesium Sand Castings," as published herein, were originally delivered as a technical paper at a W.P.B. meeting of the Magnesium Sand Casting Section, Aluminum and Magnesium Div., Cleveland, November 29-30, 1943. The paper was read at the request of the W.P.B. with the intention of disseminating information which might be of value to the magnesium foundry industry and thus possibly help the war effort. Up to this time, there has been no intention of publishing the information but, due to many and continuous requests, the author consented to its publication in AMERICAN FOUNDRYMAN. There are no revisions or additions in this publication as compared to the Cleveland presentation, except for notes and clarifications necessary to render the paper suitable for publication purposes.***


By

A. CRISTELLO

*Bendix Aviation Corp.*
*Teterboro, N. J.*


THE gating, risering and chilling of magnesium castings has been one of our problems and yours too. However, the author believes that gating has been more of a problem than risering and chilling. So, after many years of magnesium foundry experience, we, at Eclipse-Pioneer foundries, came to a conclusion about one year ago, that we could standardize on gating and be successful. In Table 1, the speaker will outline the general principles used for small, medium and large castings.

*Observations on Choking Practice*

Most of you foundrymen walk through your plant, just as the speaker does, and watch a big job being poured. You look into the risers of the mold, see the metal coming up, starting to turn black in color. Oxidation is taking place. The reason oxidation takes place is that the flow time has been retarded. It tells you that you must increase the choked sprue area in order to get a faster metal flow time.

After gating a casting, it is possible to watch it being poured and know exactly what is happening to the metal from the moment it strikes the sprue until it comes up the risers.

Gates are decided upon by our foundry engineers. Who are our foundry engineers? Who is responsible? The responsibility for production and quality lies upon the shoulders of our general superintendent and the superintendents and supervisors of our foundries. Yes, we want production but quality, above all, comes before production. Their job is to obtain quality and then production.

To get the best results with this gating method, all other operations must be controlled, such as in the melting, molding and core departments. Risering practice is outlined in Table 2.

Foundrymen attending this meeting are probably saying to themselves—"If we follow this method, will we get good results?" We have found it so—if all operations are controlled, such as melting. All foundrymen know the melting procedure. The speaker thinks that 95 or perhaps 100 per cent of the attendance in this room follow that procedure. You must have control. You must have uniformity day in and day out. The speaker does not think that the control men in the melting department should report to the Foundry Superintendent. They should report to the laboratory. It is the laboratory's responsibility to see that the procedure is followed, and that metal analysis is correct. The management of any foundry,

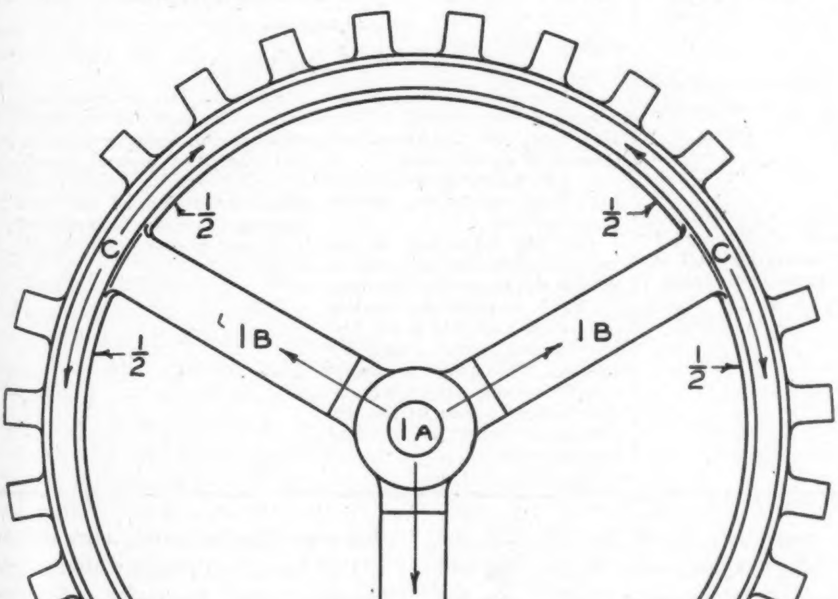



Fig. 1—Area gating for a large casting.

**Table I**

**Gating Practices**

**I—The Gate**

1. *The Size of the Gate*

(a) Thickness of the gate should be slightly larger than the wall thickness of the casting where gates are placed.
(b) The width of the gate should be about three times the thickness of the gate.
(c) The length of the gate should be slightly larger than the width of the gate.

*Reason* — So that the gate will feed the casting upon solidification.

2. *The Number of Gates*

(a) The space between the gates should be twice the width of the gates, which will determine the number of gates to be applied.

*Reason*—The space is to allow a bearing for core setting between gates, if such is the case, as well as to flow metal into the casting as uniformly as possible; insuring uniformity of metal temperature entering in all gates and resulting in equal cooling provided heavy sections are properly risered and chilled.

3. *The Location of the Gates*

(a) All gates where possible, especially on large work where metal has to drop three inches or more from drag parting line, should be located uniformly at bottom of casting to insure best results. Bottom gating gives a smoother flow of metal, less chances of oxidation, oxide skins or pin holes.
(b) In some cases the casting is best gated from the end because of directional solidification.

*Reason*—In a uniform wall casting gated from one end, the metal is lowest in temperature when it reaches the far end and, therefore, solidifies there first. The metal solidifies at the gate last because of the hot metal, and also because the sand has been heated there more, by the passage of the metal.

**II—The Runner**

1. *The Size of the Runner*

(a) The cross section area of the runner should be the same as the total cross section of the gates.

*Reason*—This is to keep the same volume of metal in the runner as is in the gate.

2. *The Shape of the Runner*

(a) The runner should be three to four times as high as it is wide.

*Reason*—This is to trap oxide and dross in the upper part of the runner, as well as to feed the gates upon solidification.

3. *The Location of the Runner*

(a) The runner should extend from the base of the gate upwards, in order to trap dross, oxide and sand in the upper part of the runner.

**III—The Sprue**

1. *The Size of the Sprue*

(a) The cross section area of the sprue should be ½ to ¼ the total area of the gates.

*Reason* — The size of the sprue determines the pouring time.

2. *The Shape of the Sprue*

(a) The sprue can be rectangular or round in shape on small castings, both types of which can easily be choked.
(b) The sprues on large castings are rectangular but sometimes oval sprues are used so as to choke up more quickly. There are cases where oval sprues and rectangular sprues are used in conjunction with each other on the same casting.

*Reason*—This prevents the metal from swirling in the sprue.

**IV—The Screens**

1. *The Use of the Screens*

(a) Screens are used on all sizes of castings.

*Reason* — Especially where there is a large volume of metal; to make sure that all oxide and fluxes are trapped.

**V—The Choke**

1. *The Location of the Choke*

(a) The choke is always at the base of the sprue.

*Reason* — This is so that a solid wall of metal is formed from the top of the mold to the base of the sprue. After the metal passes through the choke, it flows quietly through the runner and gates and into the casting with the minimum amount of pressure.

**VI—Pouring Time**

1. The pouring time of the casting is determined by the size, type, wall thickness, and amount of metal poured.
2. The following benefits result from using the correct pouring time.
(a) The advantage of the lowest temperature, thereby reducing the amount of burning.
(b) It reduces the amount of misruns and cold shuts. Oxide formed after passing through the sprue is always caught in the upper side of the runner because of the difference in height of the runner and gate.

*Reason*—The pouring time should be such as to allow metal to flow into the casting and rise at a normal speed; after checking the pouring and visual inspection of the first casting, the sprue area should be altered to correct the speed, if it is necessary.

whether manager, assistant manager or general superintendent, should be very much interested in what is going on. He should ask day in and day out, "Are we controlling all procedures, and if not, why?" If you don't control these operations, you are always going to run into trouble.

The following sketches will illustrate, in general, our idea of area gating. Figure 1 is an illustration of an inside gate for a large casting. Using the area of the sprue at the choke *(A)* as a unit of one, you will note that the area of *each* of the three feeders "B" from the sprue choke to the ring runner is one or a total of three.

### Gating a Large Casting

In other words, the flow of metal through the choke divides into three feeders, each feeder having the same volume capacity as the sprue at the choke. It should be noted that the effective screen area is four (4) to five (5) times the choke area of the sprue, in order to allow enough metal to flow into the feeders and runners.

The three feeders *(B)* connect with the ring runner *(C)*. The cross section of the ring runner at any given point is one-half the area of a feeder, because the metal running from the feeder into the ring runner divides two ways at each junction

**Table 2**

**Risering Practices**

**VII—Risers**

1. *The Use of Risers*

(a) Risers are used to feed heavy sections. Risers should be made tapered, large at top, smaller at bottom where section is fed, allowing 1/16" to ⅛" identification mark where riser should be sawed or chipped off.

(b) We prefer to use risers instead of chills wherever possible to insure soundness of section to be fed.

**VIII—Chills**

1. *Iron Chills*

(a) We use iron chills. Chills are used where risers can not be applied. Chills that are used on patterns and left in green sand mold are painted with red talc.

2. *Mixture*

(a) Tetrachloride, paraffin and talc. This mixture is applied on chills, dried; and then sent to the molding department for use. Chills that are used for cores are painted after core is baked and then dried for use. The faces of chills are grooved or have a countersunk hole to eliminate blow off chills.

of a feeder and the runner. The total cross sectional area of the runner *(C)* is then equal to the total cross sectional area of the three feeders *(B)* ($\frac{1}{2}\times6=3$) and three times the cross sectional area of the sprue at the choke *(A)*. The cross sectional area of each gate *(D)* from the runner into the casting, is ⅛ of the total cross sectional area of the runner and ⅛ of the total cross sectional area of each feeder.

Since there are 24 gates, each having a cross sectional area of ⅛, the total cross sectional area of all the gates ($\frac{1}{8} \times 24 = 3$) is equal to the total cross sectional area of the runner and the three feeders. This area gate is, therefore, composed of a sprue which is one-third the total cross sectional area of all the gates, three feeders which are equal to the total cross sectional area of all the gates, and a runner whose cross sectional area is equal to the total cross sectional area of all the gates. This can be expressed as a ration of 1-3-3.

**Single and Two-Ladle Pouring**

Figure 2 is an illustration of an area gate for a two-ladle pouring set-up. It also can be used as an illustration for a one-ladle pouring set-up, using the same type gate.

Using the one sprue pouring set-up (use the figures 1 and 1 and ¼), the cross sectional area of the sprue *(A)* is one. The total cross sectional area of the runner *(B)* is two ($1+1=2$). Here again the metal passing from the sprue to the runner divides or flows two ways into a cross sectional area at either side of the sprue, each side being the same cross sectional area as the sprue cross sectional area. The cross sectional area of each gate from the runner into the casting is ¼ of the total cross sectional area of the sprue, and ¼ of the total cross sectional area of each half of the runner.

Therefore, this area gate is composed of a choke at the sprue which is one-half the total cross sectional area of all the gates and one-half the total cross sectional area of the runner. The total cross sectional area of the runner is equal to the total cross sectional area of all the gates. This can be expressed as a ration of 1-2-2.

Using the two sprue pouring set-up (use the figures ½ and ¼) you will note that the ratio remains the same because the choke sprue area is reduced to ½ in each sprue and the runner area is reduced to ½ also. The total sprue area is then $\frac{1}{2}+\frac{1}{2}=1$; the total runner is then $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=2$. The total gate area remains the same $8\times\frac{1}{4}=2$. This can also be expressed as a ratio of 1-2-2.

Again, it must be remembered that the effective screen areas for both the one pouring set-up and two pouring set-up is four (4) to five (5) times the choke area. The same as in Fig. 1.

**Gating a Deep Casting**

Figure 3 is an illustration of an area gate for a deep casting. The cross sectional area of the sprue at *(A)* is one. The cross sectional area of the half circle runner at *(B)* is equal to the sprue area one. The cross sectional area of each vertical runner at *(C)* is one. The cross sectional area of the bottom ring runner *(D)* at any given point is ½ because the metal divides into two directions when flowing from the vertical runner into the ring runner.

The cross sectional area of each gate *(E)* from the bottom ring runner to the casting is ½. This area gate is composed of a sprue, of which the cross sectional area is half the total cross sectional area of the bottom runner ($\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=2$) and ½ the total cross sectional area of all of the gates ($\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}=2$). This can also be expressed as a ratio of 1-2-2.

The screen area at the sprue choke is again 4 to 5 times the choke area at the sprue, which is standard

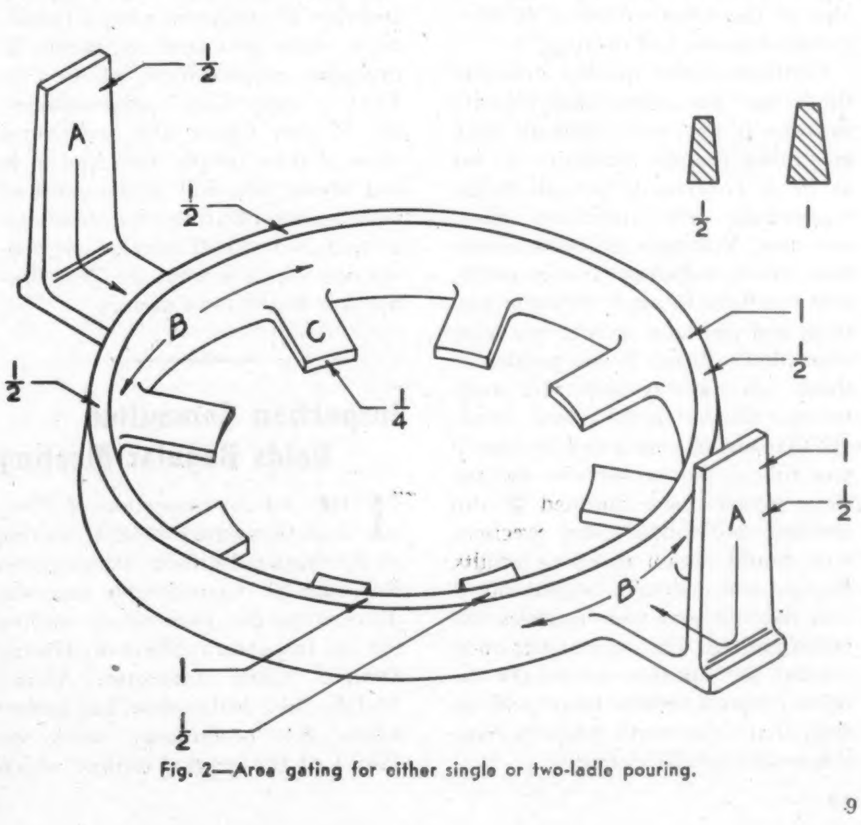



**Fig. 2—Area gating for either single or two-ladle pouring.**

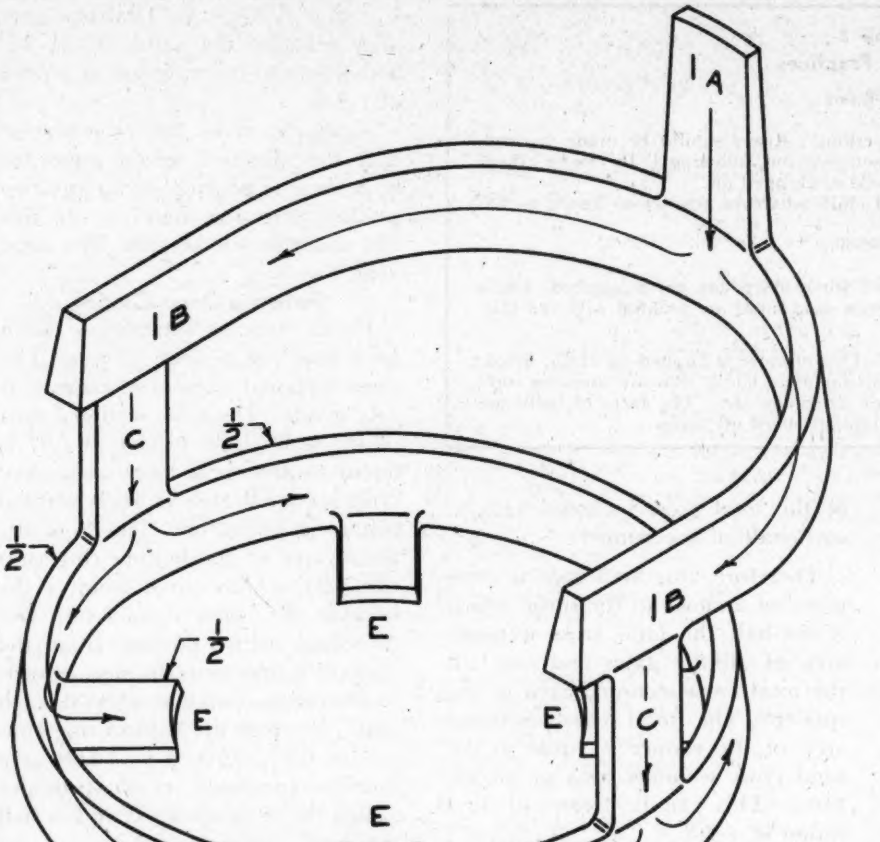



Fig. 3—Area gating for a deep casting.

practice in our foundries.

These sketches will give you an idea of just what we mean by standardized gating and risering.

Gentlemen, the speaker does not think that the magnesium foundry practice is any more difficult than any other foundry practice. As far as he is concerned, he will tackle magnesium over aluminum alloys any time. You have different aluminum alloys, different characteristics, and you have to apply different gattings and you have to riser one alloy more than others. If you gentlemen think you have trouble with magnesium because it is a new metal, get that out of your mind because if you follow the procedures the various people have outlined at this meeting and follow them precisely, you should obtain excellent results. Be sure you maintain control day in and day out and your troubles will be minimized. On some of our operations, the speaker personally receives reports every hour and he feels that it is worth while because the results are satisfactory.

You will always have scrap. You have the new employees in the plant and they do not know what a foundry is. You get sand in molds or probably misplacement of cores. That is supervision's responsibility, but if you follow the procedures some of these people have spoken to you about, you will rectify most of your troubles. By following these suggestions, we will all increase our production which is what the War Production Board most desires.

## Inspection Committee Holds Regular Meeting

THE A.F.A. Inspection of Castings Committee held a meeting at the National Offices, Chicago, on February 28. Considerable time was devoted to the preliminary outline for an Inspector's Manual. Gustav Dewald, Chief Inspector, Ampco Metals, Inc., Milwaukee, has undertaken the preliminary work on Part I of the general outline which deals with Layout Inspection; E. G. Leverenz, Chief Inspector, American Steel Foundries, Indiana Harbor Works, East Chicago, Indiana, has undertaken the preliminary work on Part II, covering Non-Destructive Testing, and Part III, dealing with Destructive Testing; and M. D. Johnson, formerly Chief Inspector, Caterpillar Tractor Co., Peoria, Ill., has undertaken the preliminary work on Part IV, pertaining to Visual Inspection.

All constructive suggestions submitted to the Committee on Inspection of Castings will be given proper consideration as the work progresses.

## Book Review

*Tool Steels,* by J. P. Gill, R. S. Rose, G. A. Roberts, H. G. Johnstin, and R. B. George. Published by the American Society for Metals, Cleveland, Ohio, 1944. Red cloth bound, illustrated, 6x9 in., 577 pages. Price $6.00.

A very complete compilation of theoretical and practical information about the common types of tool steels, prepared for those who use tool steels.

In order to give the reader an adequate background and an understanding of the basic facts concerning tool steels, the authors have introduced the subject with the history of tool steels, followed by chapters on the manufacture, testing, general properties, selection, and heat treatment of tool steels, as well as the purpose and effect of alloying elements used in tool steels.

The authors have recognized the fact that tool steels do not lend themselves to the classification by means of the principal alloying element and carbon content which is used for other types of steels. They have adopted a mixed classification based on uses, heat treatments, and applications. This classification is presented in tabular form near the beginning of the book. All types of steel listed in the tabulation are numbered and these numbers serve as references throughout the remainder of the book.

The last half of the book is devoted to a description of the properties and uses of the different classes of tool steels.

# Engineering Properties of HEAT TREATED CAST IRONS

*• **Originally presented as one of the subjects in the Metropolitan Chapter's 1944-45 Lecture Course, the object of this paper is to simplify the description of heat treating processes, and contrast "as cast" with "heat treated" in as simple a comparison as possible. The heat treatment of cast iron is comprehensively dealt with in the "Cast Metals Handbook" and "Alloy Cast Irons," published by A.F.A.***

By

J. S. VANICK

*International Nickel Co., Inc., New York*

THE definition of gray cast iron* embraces a product with an "as cast" strength range of 20,000 to 80,000 psi., a hardness of 120 to 350 Brinnell, and a machinability that varies as the strength, hardness and structure indicates. This material is essentially the product of all gray iron foundries. It occasionally dips into the output of malleable iron foundries which deliver machinable gray iron castings without applying the malleabilizing anneal.

Methods of manufacture, or alloying processes, or similar foundry practices do not exclude castings from exhibiting changes in properties in accordance with the fundamental laws governing the heat treatment of cast iron. By resorting to the simpler analogy that cast iron is essentially a steel interspersed with graphite flakes, it is obvious that the laws governing heat treatment of steel apply in general to those governing cast iron. Cast iron may be hardened, softened, strengthened, and to a moderate extent, toughened by appropriate heat treatment.

### Progress of Solidification

There is one important difference between castings of cast iron and steel. Practically all steel castings must be heat treated to break up a weak and brittle, coarsely crystalline structure that forms during solidification. Cast iron, in contrast, precipitates graphite during solidification.

This precipitation of graphite obscures and apparently obstructs the progress of crystallization such as occurs in steels, so that the amount and disposition of this graphite formed at the birth of the casting largely determines the toughness and the strength characteristics, while the composition and rate of cooling establish the final strength and toughness. This is a fundamental reason why cast iron, properly alloyed, develops excellent properties in the "as cast" form, whereas cast steel, especially if alloyed, should be heat treated to develop best results.

Unless the foundryman delivers heat treated castings to the prescribed physical property specifications, it is important for the heat treater to know all about the composition of his material to achieve the best results. This is especially important for the heat treatment of production lots of castings where a close adherence to specifications is necessary so that a standardized heat treatment may be depended upon to yield uniformly desirable results. The most common heat treatment procedures in practice today are shown in Fig. 1.

*Stress Relief Annealing*

Stress relief annealing is defined as the process of reducing internal stresses in a casting by heating it to a temperature below the transformation range and holding for a proper time at that temperature, followed by slow cooling. When properly applied, the treatment does not alter the general engineering properties of the material appreciably.

It serves mainly to apply a controlled, slow, uniform rate of cooling to castings which by their design, shape, section, composition and method of molding and gating, have cooled in the mold at irregular rates. For such castings, heating to 900-1150° F. serves to relieve any local concentration of stress. In more common cases, the treatment is applied to achieve dimensional stability where accuracy in dimensions is a required property.

Castings should be heated slowly (usually at a rate not exceeding 100° F. per hour). Large castings of irregular shape and section must be handled carefully to make sure that the heat penetrates uniformly into heavy sections and box-shaped pockets. Holding time at the annealing temperature need not exceed one hour per inch of section, unless a lower temperature, in the 800-900° F. range is used, where an additional 5 to 6 hours may be added to compensate for the slower rate of stress relief, as indicated in Table 1.

Most castings are used in the "as cast" condition. Foundrymen have applied practices which reduce internal stresses to a negligible factor. Designers have cooperated by providing uniformity and symmetry in sections. Many large castings of heavy section cool slowly and uniformly in the molds and do not retain enough residual stress to require an anneal.

The frames, beds and parts of high precision machinery may be stress relief annealed to be assured of permanence in accuracy. Large, irregular shaped castings which are heated in service and must retain dimensional accuracy are usually stress relief annealed. Steam turbine housings are a typical illustration.

Auto brake drums and clutch plates which become heated in service must be free from stresses or be stress relief annealed; otherwise, eccentricity may occur. Engine castings such as cylinder heads, blocks, liners, pistons, et cetera, may require annealing, depending upon design and foundry practice. In general, unnecessary stress relief anneal-

*American Society for Testing Materials, STANDARDS OF 1942, Part 1, p. 1090.

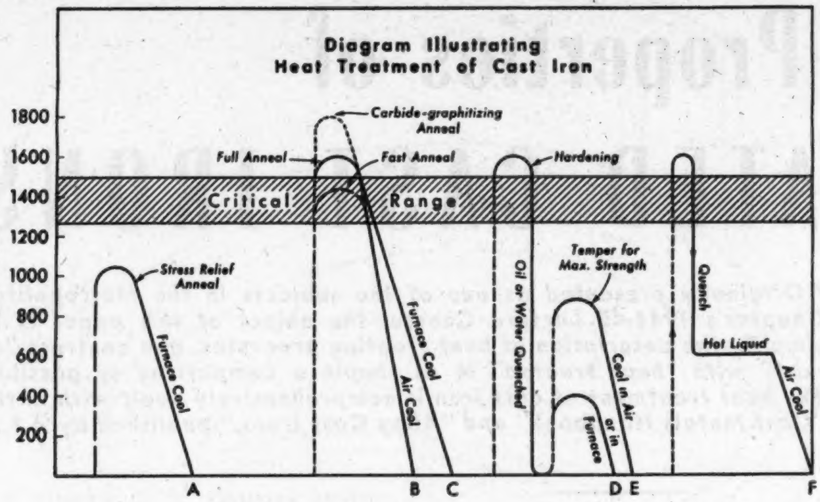



Fig. 1—Heat treatment of cast iron.

ing can do no harm, but it will add to the cost of a casting.

In some castings, a residual stress is a necessary factor to successful operation. Piston rings are a typical example. Foundrymen and engineers in general have not learned how to introduce and control favorably disposed residual stresses which could be employed to improve the subsequent performance of the equipment. This remains an attractive field for future research.

*Annealing*

Annealing has been described as a process involving heating and cooling usually applied to induce softening. The engineering properties of cast iron are altered by annealing to the extent that the strength may be decreased 10 to 30 per cent; the hardness decreased 30 to 150 units on the Brinell scale, and the structure may contain more graphite and ferrite.

### Softening for Machinability

Improvements may occur to the extent of a small increase in toughness, better thermal conductivity, greater dimensional stability, and an increase in electrical conductivity with associated electrical properties; also improved enamelability in the case of enameled ware.

Production castings which are to be hardened by quenching and tempering are often annealed prior to machining. Manufacturers equipped with heat treating facilities frequently find it economical to apply a softening anneal to castings such as cylinder liners which after machining are quenched and tempered to achieve a high hardness.

The desirable pattern of the graphite which has formed during the solidification of the casting is not altered appreciably by the anneal. The low temperature anneal (heating within the critical range) is preferred in volume production because of its time saving advantages. Annealing treatments are illustrated in Fig. 1, and summarized in Table 2, covering Annealing Treatments.

Annealing treatments "A" or "B" (Table 2) are most commonly employed. The "A" treatment requires close control, but it does not weaken the castings excessively and does not tie up furnace equipment to the same extent as "B" or "C." Certain automotive castings such as pistons may be annealed to achieve an aggregate improvement in control over uniformity in the machine shop as well as dimensional stability under elevated temperatures.

The "B" treatment softens and weakens the iron. The heating time may be prolonged until practically all of the carbon has been precipitated as graphite—and a hardness of 120 to 140 Brinell is achieved. A maximum heating rate for small castings would be about 200° F. per hour, a sojourn at the annealing temperature not exceeding 1 hour per inch of section, and a cooling rate down to 500° F. of less than 100° F. per hour. Certain kinds of hardware, typewriter parts, instrument housings and electrical equipment are typical castings.

Many thin castings produced by permanent (metal) molds may be processed through the "B" or "C" treatments to achieve toughness or machinability. Centrifugally chill cast pipe and bushings are examples. The high temperature "C" treatment requires heating to "malleabilizing" temperatures to produce machinability in castings containing "chilled iron" structures, or "white iron" in their surfaces or edges.

Heating at 1700-1800° F. (for 1 to 3 hours plus 1 hour per inch of section) will usually break down the chill, provided chill stabilizing elements such as sulphur, chromium, molybdenum, vanadium, et cetera, are not present in excess. The anneal "graphitizes the chill" and restores machinability.

The cooling rate may be timed to (1) conserve the strength by air cooling from 1700° F. to 1000° F.; then furnace cooling at a rate not exceeding 100° F. per hour to eliminate residual stress, or (2) cool from 1700° F. in the furnace or at a rate of less than 100° F. per hour to obtain a maximum softening comparable to treatment "B" above.

Heat resisting castings such as engine exhaust manifolds may be alloyed to possess a high resistance to heat. Then they may be annealed as described, for machining, while their alloy content remains to deliver substantial improvement in subsequent performance.

In other cases this heat treatment is mainly used as a reclamation measure upon castings whose composition is out of balance in terms of susceptibility to chill.

Annealing is rarely employed in regular practice because foundrymen are aware of the need to main-

**Table 1**

Summary of Stress Relief Anneal Treatments

| *Heating Rate Per Hr.-Max.* | *Stress Relief* | *Temperatures* | *Holding Time per Inch of Thickness* | *Maximum Cooling Rate* |
|---|---|---|---|---|
| 200° F. | Slow, Low Temp. Anneal | 800-900° F. | 1 Hr. + 5* | 100° F./Hr. |
| 200° F. | Typical for Soft, High Silicon Irons | 900-1050° F. | 1 — 2 Hrs. | 100° F./Hr. |
| 200° F. | Typical for High Strength Irons | 1050-1150° F. | ½ — 1 Hr. | 100° F./Hr. |

*Viz—for 4-in. section; total time=9 Hrs.

**Table 2**

Annealing Treatments

| | A Low Temp. | B High Temp. | C Chill Elimination |
|---|---|---|---|
| °F. | 1300-1400 | 1500-1600 | 1700-1800 |
| Holding Time—Hours per in. of section | 1 — 3 | ½ — 3 | 1 — 5 |
| Cooling | Slow | Slow | Slow |

**Table 3**

Approximate Tensile Strength and Hardness of Heat Treated vs. "As Cast" Irons

| Tensile Strength | | Hardness | |
|---|---|---|---|
| *"As Cast"* | *Heat Treated for High Strength* | *"As Cast"* | *Heat Treated for High Hardness* |
| 65,000 | 85,000 | 280 | 530 |
| 55,000 | 75,000 | 250 | 500 |
| 40,000 | 60,000 | 220 | 480 |
| 30,000 | 45,000 | 190 | 430 |
| 20,000 | 30,000 | 165 | 380 |

tain machinability in castings and are skilled in the methods for achieving it. Soft irons can be made with Brinell hardnesses as low as 140, and used without annealing where strength properties are unimportant and machinability is a dominant factor.

*Quenching and Tempering*

Quenching is described as a process of rapid cooling from an elevated temperature by contact with liquids, gases or solids. In the quenched condition, castings are relatively brittle and weak (Fig. 2), and for most conditions of service it is necessary to toughen them by a reheating process called "tempering."

Tempering is described as the process of reheating a hardened cast iron to a temperature below the transformation temperature range, followed by any desired rate of cooling. The engineering properties obtainable are summarized in Table 3, and it is important to point out that the high strength is developed by the high temperature tempering, while the high hardness is developed by the low temperature tempering (Fig. 1).

### High Hardness

Most of the discussions on quenching and tempering feature the strength properties that are developed, while practical operations upon castings are mainly directed toward obtaining a high hardness for resistance to wear and abrasion. One reason for this situation rests in the fact that high strengths can be produced by alloying or other means in castings without quenching treatments and with greater security in the case of complicated shapes. High hardness can usually be obtained only by heat treatments involving quenching. Descriptions in more detail follow.

When cast irons are quenched from above the critical range they acquire an increase in hardness of from 100 to 300 Brinell units. A soft, weak iron high in graphite content will show a lesser response to this hardening treatment than will a composition that is stronger and harder "as cast."

Thus, a soft iron of relatively high carbon content may be hardened from a level of 175 Brinell to approximately 325 Brinell by applying a quenching treatment, while a high strength, lower carbon type may move up in hardness from 220 Brinell to 450 Brinell. With the help of suitable alloys these hardnesses can be increased an additional 100 units to top levels of 500-550 Brinell. The common quenching media are air, oil and water.

The usual quenching medium for cast iron is an oil bath because it provides a faster cooling rate than is obtainable in air, and a slow enough rate to avoid temperature stresses and gradients of a magnitude that might cause cracking. Most of the castings that are heat treated to develop high hardness are quenched in oil from above the critical temperature range.

The usual procedure consists of heating the castings to approximately 1550-1600° F. Preheating in a separate furnace to about 1100° F. reduces the risk of cracking due to temperature differentials and cuts down the time of heating at the higher temperature, thus reducing scaling. This procedure is rarely used, and the more common practice consists of heating from a relatively low temperature to the quenching temperature in the same furnace.

### Holding Time

Castings need to be held only long enough to acquire a uniform temperature, at which time they should be quenched. Tempering should preferably follow immediately after quenching, and for best practice the casting may be at a temperature of 200-300° F. at the time it enters the tempering furnace. Castings that are heat treated for high strength usually possess a higher hardness after heat treatment than in their "as cast" condition.

Since a casting is expected to possess about the same degree of toughness that it had in the "as cast" condition, it is necessary to acquire this toughness in quenched castings by tempering after quenching. Figure 2 shows that by tempering in the range of 350-500° F. the hardness is not appreciably changed from the quenched condition, while the strength and toughness have been improved to approach their "as cast" levels.

### High Abrasion Resistance

With the alloyed irons it may be possible to heat to as high as 750° F. and retain a high level of hardness, accompanied by a further improvement in strength over the "as cast" product. Castings requiring a high resistance to abrasion which is met by a suitable microstructure at a hardness usually above 400 Brinnell, are tempered after quenching by reheating them in the low temperature range of 300-800° F. (Fig. 1).

The time at tempering usually does not exceed one hour per inch of section after the casting has acquired the desired temperature. Castings may be cooled in the furnace after tempering, thus eliminating any risk of acquiring additional internal stress due to irregular cooling. However, air cooling from the low temperatures to which castings are heated on tempering, rarely produces a cooling rate that is rapid enough to cause distortion or difficulties due to internal stress.

Engine cylinder liners are the most common type of casting processed

through the quenching and tempering heat treatment. Others are cams, gears, rollers, dies, polishing and grinding equipment, hardware, and numerous small machinery parts.

### Air Hardening

The cooling rate in air quenching is usually so slow that only very thin castings are successfully treated by this means, and then only if alloys which retard the transformations are present in adequate amounts. Heavy sectioned castings such as dies may similarly be air cooled to acquire some hardening, and because of the slow rate of heat dissipation, require much larger proportions of alloys in their composition.

### Water Quenching

Quenching in water imparts a cooling rate to cast iron which is too drastic in most cases for the castings to successfully survive the stresses raised in their surfaces by the difference in temperature between surface and underlying metal and the limited toughness of the base metal itself. Therefore, water quenching is rarely practiced.

There are special heat treatments such as flame hardening and induction hardening where the skin of a casting is locally heated to a depth usually not exceeding .125 in. and quenched by a water spray immediately following the heating operation. Most of these castings are not subsequently tempered, and the successful use of this hardened surface is made possible through the shallow zone that has been treated and the absorption of the accompanying stresses by the tougher, unheated, underlying metal.

The local application of heat by the flame hardening or induction hardening processes involves close attention to mechanical details and conditions of surface in order that the heat flow into the casting may be uniformly controlled. The procedure is limited to applications which possess contours, dimensions, and hardness requirements that are satisfied by a local and shallow hardening of accessible surfaces capable of absorbing the stresses accompanying rapid heating and cooling.

Apparently the properties of the water quenched zone are similar to those prevailing in quenched material prior to tempering. Typical castings which are heat treated in this manner are the wearing surfaces of lathe beds, certain gears and cams, rollers, plungers, cylinder liners, etc. These surface hardened castings are ordinarily used under conditions of loading in which surface pressures are relatively light and the need for a hard, strong underbody does not exist.

### High Strength

It is possible to add 10,000-25,000 psi. additional to the strength of a cast iron that has been quenched in oil and tempered (Fig. 2). Tempering after quenching to produce a high strength consists of reheating the quenched castings to a temperature of 600-1000° F. Most cast irons acquire their maximum strength with this tempering treatment which leaves them some 20 to 100 Brinell units harder than they were in the "as cast" condition.

If the tempering treatment after quenching is carried out to restore the "as cast" hardness, it is usually found that the "as cast" strength is restored and no improvement from heat treating is obtained. Consequently, the machinability of these irons that have been heat treated for high strength is inferior to their machinability in the "as cast" condition. The advantages of the treatment rest in the possibility that machining operations may be performed on the softer "as cast" product, after which the stronger and harder castings can be completed by minor machining operations.

### Little Change in Impact Strength

The impact strength of a cast iron is not appreciably changed by heat treatment, except in the poorer grades of iron where a low strength and a low combined carbon content exist in the "as cast" condition. In general, the impact resistance is less after quenching and tempering than existed in the original "as cast" condition. Any expectation of an increased impact resistance should be carefully investigated. The modulus of elasticity is similarly unchanged or not improved by the quenching and tempering type of heat treatment.

A special type of heat treatment, limited in its application to castings that can be quenched in a hot salt or lead bath, has been used where a combination of hardness and toughness produces a desirable wear resisting structure. This is called a "hot quenching treatment," which treatment with the above explanation adequately defines the process.

In practice, castings of suitable composition are quenched from above the critical range into a bath at a temperature of 450-800° F. and held for sufficient time to obtain the desired change in structure. Usually 2 to 5 hours in the quenching bath is sufficient, but longer intervals have been tested out experimentally. The resulting castings possess a hardness in the range of 280-380 Brinell,

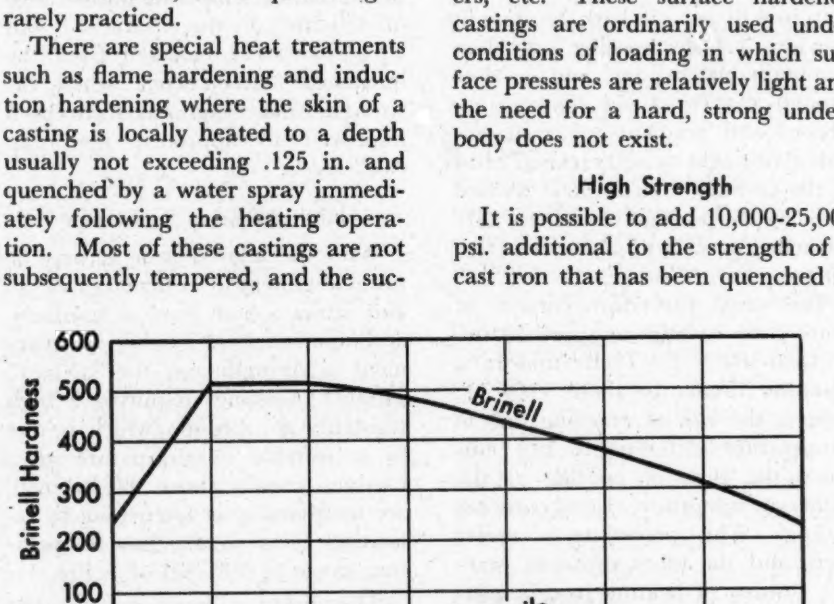



Fig. 1—Change in properties with drawing temperature for a nickel-molybdenum cast iron.

and for their hardness level they posses a higher degree of toughness than occurs in castings that have been cold quenched and tempered to the same hardness value.

Toughnesss tests as measured by the deflection or A.B.[1] impact test indicate that these irons are much tougher than companion pieces that have been hardened by quenching and tempering in the usual way. Bartholomew[2] reports that at the same hardness as quenched and tempered castings, the hot quenched castings are able to carry twice the load for the same degree of wear, or conversely, carry the same load two or three times as long. The operation has been limited to cams, gears and similar heat treatable castings whose service requires of them a high resistance to wear.

[1] Arbitration bar specimens 1.125 in. dia. by 8 in. long broken on 6 in. span in the Charpy test, or arbitration bar specimens 1.125 in. diam. by 3 in. above supports in the Izod test.

[2] Bartholomew, E. L., "*Gray Cast Iron*," The Iron Age, Aug. 1, 1940, pp. 52-54.

# FOUNDRY EDUCATION FUND

## *Established by Western Michigan Group*

MEMBERS of the West Michigan Chapter, realizing the necessity of making the foundry a better place in which to work, the desirability of new and improved methods of production and quality control, and the introduction of men with proper background into the industry, have established the Donald J. Campbell Educational Fund.

The purpose of this fund is to assist young men interested in the foundry industry to obtain a college education. The Chapter feels that by educating such individuals, new ideas will be developed which will eventually place the foundry industry among the most forward-looking industries in the country and increase the desirability of the industry as a place to work.

The Board of Directors of the West Michigan Chapter has set up a committee to administer the fund and to draw up plans of operation for the educational fund. Preliminary plans already drawn now are receiving final check before the plan is placed in operation. The fund will be administered by the following committee:

Gray Iron Foundries — Harold Bement, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.; Piston Ring Foundries—Rudy Flora, Clover Foundry Co., Muskegon; Steel Foundries — George Meyers, West Michigan Steel Foundry Co., Muskegon; Non-Ferrous Foundries —A. E. Jacobson, Grand Haven Brass Foundry, Grand Haven; Malleable Foundries—Ralph J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich.

Under the plan for operation of the fund, any member of the West Michigan Chapter has the first opportunity to submit names of possible candidates to the above committee for schooling under this educational fund.

Your Association extends congratulations to the West Michigan Chapter for its forward-looking policy and especially for the contribution which it is making to increasing the stature of the foundry industry in the West Michigan area. The Chapter has set an example which it might be well for other Chapters of A.F.A. to follow.

## Clamer Medal for Dr. Zay Jeffries

SELECTION of Dr. Zay Jeffries, vice-president of General Electric Co., Cleveland, as winner of the Clamer Medal of The Franklin Institute, Philadelphia, was announced recently by Dr. H. B. Allen, secretary and director of the Institute.

The Francis J. Clamer silver medal is awarded at least once in five years for achievement in the field of metallurgy. Dr. Jeffries will receive it this year "for his meritorious contributions to the science of metals, which he has placed on a new and more intelligible basis."

Dr. Zay Jeffries was born at Willow Lake, S. D., in 1888. He was graduated in 1910 from the South Dakota School of Mines, and successively received degrees of Bachelor of Science, Metallurgical Engineer and Doctor of Engineering. The management of the Aluminum Castings Co. became interested in the young scientist when he discovered the cause of the cracking of aluminum pistons. He was made director of research of that company in 1916, and became one of the scientific leaders of the aluminum industry.

He was consultant with the National Lamp Works of General Electric Co. from 1914 to 1925 and was appointed technical director of the Incandescent Lamp Department of the same company from 1936-1945. Dr. Jeffries became president of one of its affiliates, the Carboloy Company, in 1932, and at the present time serves as chairman of the board. On January 1, 1945, he became a vice-president of General Electric Co. and general manager of its new Chemical Department. He is vice-chairman of the War Metallurgy Company of the National Academy of Sciences.

## 2d Regional Conference For Eastern Canada

MEMBERS of the Eastern Canada and Newfoundland Chapter conceived the idea of the Maritimes Conference which was held in Nova Scotia last year because of the number of foundries in the Maritime Provinces, and a desire on the part of the Chapter to share the benefits of American Foundrymen's Association in greater degree with Maritime members.

The success of the meeting has prompted the group to schedule another two-day Regional Conference this year in Montreal, May 17-18, in an effort to bring together the members from all the territory served by the chapter.

A diversified and comprehensive program is centered about three principal discussion groups: "Gates and Risers," "Sand," and "Melting Practice." Plant visitations are expected to include foundries of the following companies: Canadian Bronze Co.; Canadian Car Steel Foundry Div.; Canadian Car Turcot Foundry; Crane, Ltd.; W. R. Cuthbert & Co.; Dominion Engineering Works, Ltd.; Gurney Foundry; Jenkins Bros. Ltd.; Warden King, Ltd.; Robert Mitchell Co., Ltd.; Montreal Technical School, and Peacock Bros.

# RESPONSIBILITY
## *Industry vs. Public Agencies*
# FOR POST-WAR APPRENTICESHIP

**• *The Director of the Apprentice-Training Service gives credit to the A.F.A. Apprentice Training Committee in this paper which was presented at the 8th Annual Regional Conference of the Wisconsin Chapter, February 8, 1945, at Hotel Schroeder, Milwaukee.***

By
WM. F. PATTERSON
*War Manpower Commission, Washington, D. C.*

IN VIEW of the almost continuous manpower problem in the foundry industry since the war started, the production figures chalked up by the foundries are almost beyond belief. With the end of the war still a long way off, the industry must continue to perform production miracles regardless of the manpower situation. *There can be no relaxation.*

While this country has been able to produce the sorely needed equipment for our fighting forces, the lack of skilled manpower—and I am sure nearly everyone will agree with me in this—has been one of the most serious if not *the* most serious obstacle to production. Although our war plants have been able to train and utilize partially skilled workers through the development of mass production methods and division of labor, there has been great need, just as there was during the first World War, for all-round skilled men.

### Need for Skilled Men

To meet the production demand is today, more than ever before, a manpower problem. The continued call for men by the armed forces is not an encouraging outlook for our industrial army. The answer to the problem must, therefore, be largely that of increasing still further the skill and production efficiency of foundry workers and the employment and training of workers who have never seen the inside of a foundry.

**An instructor discusses gating and risering with two students at Northwestern Technological Institute where practical training is an important phase of the educational program.**

Even if our industries had a sufficiently large skilled force for immediate needs, it would still be necessary to train additional men continuously to maintain the quota of skilled workers needed. Unless new young blood is syphoned into industry through apprentice training, its skilled worker force is destined for a serious depletion.

I mention this because of the number of skilled workers who must retire every year due to increasing age, and the number who die. So long as sufficient skilled workers are still on the payroll, the fact that many of them are growing older is not always noticed. Because of this situation, Apprentice-Training Service recently made a study of this question to have factual evidence on what is happening.

### Fewer Apprentices

Let us glance for a minute at the data we have computed, for example, with respect to molders. This study shows that from 1910 to 1940 the average age of skilled molders has risen from 35½ years to over 42 years. During this same period, the number of young men entering the trade—that is, the apprentices and other workers under 20 years of age—has decreased fully five per cent.

### Survey Shows Decline

In our studies of the patternmakers and cabinetmakers, boilermakers and machinists, equally alarming figures are shown regarding the increasing age of skilled men, and the dropping off of young workers who should be entering the industry to replace the older workers who are leaving.

These figures are based on census records for the 30 year period ending in 1940. How the age distribution will stand at the end of the war cannot be forecast with any accuracy, but it is difficult to see how the situation can improve with so large a percentage of the younger men in military service.

I have been asked to talk on the subject of responsibility in apprentice training—industry's versus public agencies' responsibility.

### Industry's Responsibility

Since apprentice training, as conducted today in accordance with modern methods, is given almost entirely on the job, under the direction of experienced workers in the industry, and apprentices are, in actuality, part of the production force, their training must inevitably be industry's responsibility. I am sure no one engaged in industry will disagree with that statement.

Apprentice training is, after all, a method of producing skilled workers, just as coremaking and molding are methods in producing foundry products. And it is the responsibility of those in charge of training in a plant to see that the methods employed are properly executed, and the results obtained are all that can be desired.

This brings me to the subject of the part Apprentice-Training Serv-

*(Photo courtesy Northwestern Technological Institute)*

**Good foundry training begins with proper safety precautions.**

ice plays as a national agency. It is our job to assist industry—and I mean by that, every individual plant that requires assistance—in determining the best methods to develop all-round skilled workers.

Although some plants do not require assistance, there are thousands of plants throughout the United States that do, and officials of those plants admit frankly that they would not know how to go about it. Also, the plants in which an adequate system of apprenticeship has been in operation for years are constantly on the alert for new methods and new techniques which will improve the system already established.

It is the job of Apprentice-Training Service, therefore, to see to it that everyone concerned with training in every industry is currently informed on the best methods and practices as determined by experience. In other words, our chief job is to function as an information clearing house on the subject of apprenticeship.

### Industry Supplies Information

Whatever information we have to offer those concerned with training in a plant or area is based on information we have obtained from industry itself. It is compiled from factual data accumulated largely by ATS field men in studying the production, manpower and training requirements of the thousands of industrial plants throughout the nation. Even if we knew all the answers to any training problem—which we don't and we are frank in admitting we don't—it would not be our job to tell anyone engaged in an industry what to do.

In rendering this service, I like to think of ATS as a part of industry, the Training Branch of American Industry. And I believe we have succeeded, at least to some extent, in earning that distinction.

In order to give you an over-all picture of the work involved in rendering the service assigned to us, I might mention specifically some of our regular duties which supplement those performed by ATS field men in analyzing training problems and recommending solutions.

### Guidance for Instructors

For the guidance of those responsible for training throughout the various industries, we publish and distribute copies of outstanding examples of apprenticeship programs (apprenticeship standards, as they are called)—those which are exceptionally well planned or contain distinctive new features which merit their use as models.

Another function of our agency is that of registration. Each individual apprenticeship agreement, after the proper signatures are affixed, is officially registered and filed by our Washington office or by a State apprenticeship agency.

In Wisconsin and 25 other States these agreements are registered by the State apprenticeship agency established there. One of the chief reasons for registering agreements is to keep a record of the number of apprentices who are employed currently in each trade, industry and location.

### National and State Trends

Our technical staff makes detailed studies of national and State trends in apprenticeship activities in the various industries, and also detailed studies on techniques of record keeping and other topics related to apprentice training, as, for example, our pamphlet entitled, "Evaluating Apprentices."

Our information staff also issues bulletins and pamphlets, such as "The National Apprenticeship Program," "Training Teamwork," "Looking Ahead by Way of Apprenticeship," "Apprentice Training for Veterans," "Apprentice Training for America's Youth," as well as reprints of articles which have appeared in employer and labor magazines on different training programs. Many of you here are familiar with the pamphlets and reprints we have made available.

So that the general public in each part of the country may be currently informed on apprenticeship activities, each of our regional and field offices, as well as our National office, supply current information to the newspapers. During the last year, hundreds of stories have appeared in the newspapers on conventions and other meetings of management and labor groups, at which training problems are discussed and speeches

**A group of apprentices are receiving instructions in pattern making and engineering design in the apprentice training program sponsored by the Caterpillar Tractor Co.**

delivered by members of our staff and representatives of industry, vocational education authorities, State apprenticeship agencies and other government officials. Information is also supplied to the newspapers on new training programs established; apprentice graduation ceremonies and other topics of interest to the public.

All of this dissemination of information is necessary in order to bring about a greater understanding and gain the support of the general public, as well as those engaged in the different industries who are responsible for training. Circulation of this informational material is an essential and major part of our administrative work, not merely a job supplementing administrative work.

In this connection, I don't know if any reader has ever read the Federal law that authorized our establishment in 1937 in the U. S. Department of Labor—the Fitzgerald Act, as it is called. Although it is only four brief paragraphs long, the word "promotion" or "promotional" appears four times and the word "publish information" appears in the second paragraph.

### General Participation

The task of apprentice training and securing apprentices who are qualified must be a cooperative undertaking in which the general public, as well as all organizations and agencies—both public and private, directly or indirectly concerned with in-plant-training and vocational education and employment—must participate. Industry must have the intelligent participation of all those participating in order to carry forward and expand the National apprenticeship program.

A great deal of the information we have collected on training in the foundries has come to us from the Apprenticeship Committee of the American Foundrymen's Association. This committee is an indispensable clearing house itself of information on techniques and methods of apprentice training for foundry work.

Other associations which have contributed valuable data are the National Founders' Association, the Steel Founders' Society of America and the Gray Iron Founders' Society. We have also as a source of information the International Molders' Union and other labor organizations in the industry. Included among our informants is John P. Frey of the American Federation of Labor who is a member of the Federal Committee on Apprenticeship and also is himself a molder by trade.

C. W. Wade, apprentice instructor at the Caterpillar Tractor Co., is seen giving a demonstration in molding methods to employees of the apprentice training course.

Incidentally, I might add that each of our 180 field consultants is a representative of industry, for each of them has had on-the-job experience at some time during his career. In fact, most of them have served an apprenticeship in some skilled trade. Thus, each ATS field man has a fund of practical, realistic, personal experience upon which he can draw.

### Continuous Training

All of us have learned a lot during this war about the necessity for continuous apprentice training in our plants. We have learned our lesson through bitter experience and the costly procedure of trial and error.

Although the foundry industry and every other major industry will always require a large number of workers to perform the specialized, single-track jobs required in the plant, the vast majority of industries will always need, too, a large proportion of all-round men, the men who can be relied upon to perform the work requiring versatility, ingenuity and a multiplicity of skills. And these workers cannot be trained on short notice.

While much was done in the foundry industry prior to the war to build up the ranks of skilled molders, coremakers and patternmakers, as well as boilermakers and machinists, through apprenticeship, what was accomplished was too late to offset the dire need for thoroughly trained, all-round men, when the pressure for war production was underway. And when the war production program was on, it was next to impossible to carry on extensively with apprenticeship programs.

It is hardly necessary to mention the difficulties with which every industry has been faced during the war in filling the quota of apprentices needed. Many plants have employed as apprentices less-than-draft-age youths—those in the 16 and 17 year old brackets—and also older men than are usually accepted for this training, as well as some women.

Lately, many employers have employed returning veterans. In addition to the fact that employers need the services of veterans as potential craftsmen, they are anxious to give them the opportunity they deserve to train for a career through apprenticeship.

### Selection of Veterans

In selecting veterans for apprenticeship, every industry—the foundries especially—must be certain that they are physically able to perform all the work required of craftsmen. It would be of no advantage to a veteran or his employer if it were

found before he completed his training that the work was too heavy or too tiring.

Veterans who qualify for apprenticeship have the advantage of monthly subsistence payments provided by the "G. I. Bill." These payments, which are in addition to the apprentice wage, range from $50 to $75 as a maximum, depending upon whether the veteran has dependents. For obvious reasons, the government payments are adjusted when necessary at some period in the apprenticeship, so that the combined wage and government allowance do not exceed, at any time, the journeyman rate in the trade in which the veteran receives his apprentice training.

Despite the obstacles of war conditions, some large plants in the foundry industry have done a superb job in expanding their apprentice training programs, and also many foundries have established apprenticeship programs for the first time. The industry, as a whole, however, has still a long way to go before it has reached the quota of apprenticeship training programs to fill the never-ceasing demand for all-round skilled workers.

### Training Facilities

Throughout the nation there were, according to the Census of 1940, the last peacetime year, as many as 11,000 plants in the foundry industry. Since the war began, many additional plants have been erected and many other plants, as well, have been converted to foundry work of some kind—the production of castings, patternmaking or fabrication. Certainly, a large proportion of these plants have adequate facilities for providing all-round training for apprentices.

Let us glance now at the number of plants in the industry which have adopted apprenticeship programs. According to ATS records, only about 450 plants in the foundry industry have set up apprenticeship systems to train men for molding and coremaking. There are about 550 establishments, many of these jobbing pattern shops, which have established apprentice training programs to develop patternmakers. In other words, only about one-tenth of the number of plants which could train apprentices for foundry work are now doing so.

So as not to paint too gloomy a picture, I will add that Wisconsin is far in the lead of the rest of the States in apprenticeship activities. I know there are nearly 50 foundries in this State which have apprenticeship programs for molders and coremakers, and about the same number that have programs to train apprentices in patternmaking.

It is generally admitted that many companies, such as the Falk Corporation, Allis-Chalmers Mfg. Company, and the Fairbanks Morse Company, to name only a few at random, have for a long time conducted first-rate apprentice training programs. These large companies, however, can develop through apprentice training only about 20 per cent of all the foundry mechanics that are required. The great majority of apprentices must be trained in small shops employing from 10 to 100 workers.

### Continuous Training

The 1940 Census also records that 87,600 skilled molders and coremakers were employed in the 11,000 establishments I have mentioned; and 33,000 skilled patternmakers were employed in the foundries or in patternmaking shops serving the foundries. In order to determine what these statistics mean in terms of the number of apprentices who must be trained, Apprentice-Training Service has made a detailed study of the subject. This study shows that in order to maintain a force of 87,600 molders and coremakers, 10,300 apprentices must be in training continuously, 3,500 apprentices must be hired each year and 1,500 graduated.

Turning now to patternmakers, in order to meet the quota of 33,000 skilled patternmakers, 3,800 apprentices must be in training all the time, 950 additional apprentices must be employed annually and 450 must be graduated to full-fledged craftsmen each year.

These figures allow for turnover of both skilled men and apprentices, but do not allow for the increase over 1940 of the number of apprentices who may be required today and in post-war years.

### Future Manpower

The situation today can be summed up in the statement that whereas the foundry industry, and this industry is not an exception by any means, had previously committed itself to a comparatively slow-growing national program of apprenticeship, it now becomes necessary to do in a few short years what should have been done in 10 or 15 years. American industry cannot afford to be complacent with respect to training. It must be on the alert if it is to have the skilled worker force it needs today, and will need more than ever before in post-war years. It is essential that every industry take stock of the situation, and make plans to expand its apprenticeship programs so as to build up and maintain its quota of skilled manpower in future years.

## Review of Report On Molding Sands

By Dr. H. Ries

COMPOSITION and Properties of Molding Sands, Part 1—Nature of A.F.A. Clay Fraction Removed from Natural Molding Sands—by L. H. Berkelhamer, U. S. Bureau of Mines, Reports Investigations 3774, 1944.

This is a lengthy and interesting report which should be read in detail because only the main features are touched upon in this review. The author states that too little attention has been given in the past to a better understanding of the nature of the bonding material—A.F.A. clay—in naturally-bonded sands.

In this study 22 samples of naturally-bonded sands were used. The A.F.A. clay in each was separated and collected.

These separates were then subjected to the Truog method of treatment which removed colloidal binding and interfering substances from the larger size, soil material so as to allow discrete particles to exert their individual properties.

The constituents removed by the Truog treatment ranged from 2.5 to 25 per cent. They consisted of organic matter, free iron oxide, inorganic base exchange material, colloidal silica and free alumina.

The fusion points of the A.F.A. clays were determined in terms of pyrometric cones and ranged from cones 10-34. A connection was observed between P.C.E. value and dehydration loss between 400° and 600° C. When the A.F.A. clay was

mixed with the pan material, the P.C.E. was lowered as much as 5 cones. The A.F.A. clays were found to be divisible into two groups, those with a P.C.E. of cone 20 or higher and those below 20. The Truog treated clays of group 1 were essentially kaolinite with minor amounts of quartz and illite. Those of group 2 showed dominance of quartz or quartz and illite with minor amounts of montmorillonite or kaolinite.

No refractoriness tests were made of the clays after Truog treatment.

Tests for elevated temperature deformation, green, dry and hot compression, and green permeability, were made, but no simple correlation could be made between these and the A.F.A. clay properties. This was probably due to the fact that there were so many variables involved.

The report concludes with a bibliography and a series of charts giving the properties of each A.F.A. clay tested.

# I.B.F. EXCHANGE PAPER

## *Is Work of Two Non-Ferrous Assn. Men*

W. A. Baker

E. A. G. Liddiard

THE official exchange paper from the Institute of British Foundrymen, as a contribution to the A.F.A. program for 1945, has been prepared by Messrs. W. A. Baker and E. A. G. Liddiard, British Non-Ferrous Metals Research Association, England. The subject of their paper, which will be presented to Association members through the pages of the AMERICAN FOUNDRYMAN and reprinted in the bound volume of TRANSACTIONS, is "Cause and Control of Microporosity in Magnesium Alloys."

W. A. Baker, one of the authors, was Assistant Chemist at the Royal Mint, London, from 1929 to 1935, and after graduating at the London University in 1934, he joined the staff of the British Non-Ferrous Metals Research Association as Junior Investigator in 1935. Since 1939 Mr. Baker has served as Senior Investigator in charge of the Association's researches on melting and casting of non-ferrous metals.

E. A. G. Liddiard, co-author, was Laboratory Assistant at the Cyclops Steel Works of Messrs. Camel Laird and Co., Ltd., Sheffield, from 1922 to 1925. After graduating from Gonville and Caius College, Cambridge, in 1932, he served as Research Metallurgist with I.C.I. (Synthetic Ammonia and Nitrates) Ltd., Billingham, from 1928 to 1932. In 1932 he was appointed Assistant Development Officer to the British Non-Ferrous Metals Research Association, becoming Assistant Research Superintendent in 1938 and Research Manager in 1943.

***Watch for the May AMERICAN FOUNDRYMAN which will introduce a new service.***

# NEW ASSOCIATION MEMBERS

**(February 16 to March 15, 1945)**

***• Twenty chapters out of the 29 contributed to the month's New Member total of 132. Following the usual trend, the "baby" chapter—in this case, Oregon—leads with 12 additions, while Birmingham, Central Ohio, and the Saginaw Valley group tie for second place honors with a tally of 11 each. Chicago, with a total of 10 new members, has an unchallenged claim for honorable mention.***

*Sustaining Members*

***Cadillac Motor Car Div., General Motors Corp., Detroit (H. B. Swan, Foundry Sup't.).**
***Kelsey-Hayes Wheel Co., Detroit (George J. Delisle, Chief Met.).**

## BIRMINGHAM CHAPTER

E. H. Abbott, Thomas Foundries, Inc., Birmingham.
Robert Bedford, Foreman Steel Foundry, American Cast Iron Pipe Co., Birmingham.
Alvin Binzel, Jr., American Cast Iron Pipe Co., Birmingham.
L. C. Cobb, Foreman Machine Shop, American Cast Iron Pipe Co., Birmingham.
William R. Hargett, Thomas Foundries, Inc., Birmingham.
George M. Hayes, Thomas Foundries, Inc., Birmingham.
W. H. Huffaker, Core Room Foreman, American Cast Iron Pipe Co., Birmingham.
Sidney K. Ray, Foreman, American Cast Iron Pipe Co., Birmingham.
J. R. Reynolds, Thomas Foundries, Inc., Birmingham.
Chas. Hugh Smith, American Cast Iron Pipe Co., Birmingham.
Herbert A. Strickland, American Cast Iron Pipe Co., Birmingham.

## CANTON DISTRICT CHAPTER

Louis M. Sell, United Engineering & Foundry Co., Canton, Ohio.
Leroy Venarge, Met., Atlantic Foundry, Akron, Ohio.

## CENTRAL OHIO CHAPTER

***The Aetna Fire Brick Co., Oak Hill, Ohio (L. F. Sims, Gen. Mgr.).**
R. E. Colegrove, Foundry Production Sup't., Marion Steam Shovel Co., Marion, Ohio.
***The Columbus Brass Mfg. Co., Columbus (L. E. King, Pres.-Treas.).**
W. E. Dole, Prop., Oak Hill Foundry & Machine Works, Oak Hill, Ohio.
Howard E. Edsall, Foundry Sup't., Marion Steam Shovel Co., Marion.
Clarence F. Gorenflo, Core Foreman, Marion Foundry Co., Marion.
J. Gray Lummis, Dist. Mgr., A. P. Green Fire Brick Co., Columbus.
Joseph E. Scandling, Met., Marion Steam Shovel Co., Marion.
Earl A. Swenson, Repr., Ironton Fire Brick Co., Ironton, Ohio.
Prof. Walter E. Thrun, Valparaiso University, Valparaiso, Ind.
Karol Whitlatch, Sales, Aetna Fire Brick Co., Oak Hill, Ohio.

## CHICAGO CHAPTER

***Edw. S. Christiansen Co., Chicago (T. J. Gallagher, Sales Mgr.).**
Ralph M. Coe, Safety Engr., Dodge Chicago Plant, Chicago.
P. W. Fromm, Time Standards Engr., Western Electric Co., Chicago.
G. L. Mock, Molding Foreman, National Malleable & Steel Casting Co., Chicago.
***Saginaw Malleable Iron Div., General Motors Corp., Plant No. 2, Danville, Ill. (F. E. Bassett, Plant Mgr.).**
James Annita, Pattern Shop Foreman, Inland Steel Co., East Chicago, Ind.
F. G. Schaub, Treas., Calumet Steel Castings Corp., Hammond, Ind.
Joseph Winsky, Foreman, Pettibone-Mulliken Corp., Chicago.
James Watson Wolfe, Field Man, Non-Ferrous Founders Society, Chicago.
Bernard L. Zeller, The Western Foundry Co., Chicago.

## CINCINNATI DISTRICT CHAPTER

Robert L. Westmoreland, Pattern Maker, Wright Aeronautical Corp., Cincinnati.

## DETROIT CHAPTER

C. F. Benson, Cadillac Motor Car Div., General Motors Corp., Detroit.
W. H. Curtin, Cadillac Motor Car Div., General Motors Corp., Detroit.
B. Eldridge Drury, Jr., Service Engr., Wilson Foundry & Machine Co., Pontiac, Mich.
Ralph E. Harrington, Chief Foundry Clerk, Wilson Foundry & Machine Co., Pontiac.
W. E. Kidwell, Ass't. Foundry Met., Packard Motor Car Co., Detroit.
***Frank J. Novak Foundry, Detroit, (Miss Mary Novak).**
Earl J. Smith, Jr., Met. Engr., Ford Motor Co., Dearborn, Mich.
L. W. Thayer, Foundry Ass't. Sup't., Cadillac Motor Car Div., General Motors Corp., Detroit.
B. C. Treves, Cadillac Motor Car Div., General Motors Corp., Detroit.

## EASTERN CANADA & NEWFOUNDLAND CHAPTER

***Canadian Vickers Limited, Montreal, Quebec (J. Campbell, Pattern Shop Foreman).**
Edwin A. Highet, Maritime Repr., Canada Metal Co., Ltd., Montreal, Quebec.
***Northern Foundry Ltd., Montreal, Quebec (Napoleon Paquin, Mgr.).**
William Rousseau, Foreman, Northern Foundry Ltd., Montreal, Quebec.

## METROPOLITAN CHAPTER

Edward M. Getzoff, Bendix Radio Div., Bendix Aviation Corp., Red Bank, N. J.
Harold C. Harris, Fdry. Met., Mack Mfg. Corp., New Brunswick, N. J.
Research Library—Sperry Gyroscope Co., Inc., Garden City, N. Y.
Philip Shomer, Engr., Precision Casting Research Div., Eclipse Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.
Jerome F. Walker, Fdry. Coordinator, Wright Aeronautical Corp., Paterson, N. J.

## NORTHEASTERN OHIO CHAPTER

J. W. Cleveland, Hydro-Blast Corp., Chicago.
Robert E. Goodfriend, Service Engr., Joseph Dixon Crucible Co., Shaker Heights, Ohio.
Charles D. Pinkerton, Jr., Repr., Mineral City Sand Co., Mineral City, Ohio.
H. L. Sherman, Plant Engr., The Duraloy Co., Scottdale, Pa.

## NORTHERN CALIFORNIA CHAPTER

James D. Hairston, C.ML., U.S.S. Black Hawk, c/o F.P.O., San Francisco.
William Kiley, Molder, Enterprise Engine & Foundry Co., So. San Francisco.
Charles J. Pullaro, ML. 1/C, U.S.S. Black Hawk, c/o F.P.O., San Francisco.
Jos. A. Monte Verda, Leadingman, Mare Island Navy Yard, Mare Island, Calif.

## ONTARIO CHAPTER

***Bowman Bronze Co., Hamilton, Ontario (Peter V. Bowman, Sec.-Treas.).**
M. W. Hollands, Plant Met., Walker Metal Products, Ltd., Walkerville, Ontario.

## OREGON CHAPTER

Arthur V. Andersen, Foundry Foreman, Electric Steel Foundry Co., Portland.
Vincent E. Be Lusko, Sub. Ass't., Electric Steel Foundry Co., Portland.
Carl Gettman, Foundry Foreman, Electric Steel Foundry Co., Portland.
J. Otis Grant, Electric Steel Foundry Co., Portland.
Henry L. Hellman, Foreman, Electric Steel Foundry Co., Portland.
Frank P. Ofner, C. R. Sup't., Electric Steel Foundry Co., Portland.
S. E. Peeler, Sup't., Electric Steel Foundry, Portland.
John A. Petersen, C. R. Foreman, Electric Steel Foundry Co., Portland.
Phil L. Romage, Molder, Electric Steel Foundry Co., Portland.
Geo. J. Schopf, Core Room Foreman, Electric Steel Foundry Co., Portland.
R. Simpson, Met., Electric Steel Foundry Co., Portland.
H. L. Tatham, Sup't., Pacific Steel Foundry Co., Portland.

## PHILADELPHIA CHAPTER

Francis V. Bortz, Met., Treadwell Engineering Co., Easton, Pa.
Charles Donnelly, Molder Foreman, Lancaster Malleable Castings Co., Lancaster, Pa.
L. H. Scheifele, Engr. of Tests, Reading Co., Reading, Pa.
A. L. Wentzel, Birdsboro Foundry & Machine Co., Birdsboro, Pa.
Edwin A. Zeeb, Ass't. Fdry. Foreman, Dodge Steel Co., Philadelphia.

## QUAD-CITY CHAPTER

A. J. Andre, Service Engr., E. F. Houghton & Co., Davenport, Iowa.
Floyd Bellegante, Foundry Foreman, Blake Mfg. Co., Rock Island, Ill.
***Blake Mfg. Co., Rock Island, Ill. (William F. Bernbrock, Vice Pres. in Charge of Mfg.).**
C. L. Briceland, Dir. of Purchases, Ordnance Steel Foundry Co., Bettendorf, Iowa.
Joseph F. Lysaught, Service Engr., Cardinal Supply & Mfg. Co., Omaha, Nebr.
Lawrence H. Phillips, Foundry Chemist, John Deere Tractor Co., Waterloo, Iowa.

## ROCHESTER CHAPTER

Roy C. Owens, Melting Foreman, The S nington-Gould Corp., Rochester, N. Y.

*Company Member.

## SAGINAW VALLEY CHAPTER

Donald R. Billsbrough, Foreman, General Foundry and Mfg. Co., Flint, Mich.
Robert R. Busler, Metallographer, Saginaw Malleable Iron Div., G.M.C., Saginaw, Mich.
Robert C. Cornell, Research Met., Dow Chemical Co., Midland, Mich.
Carl L. Courtade, Opr. Met., General Foundry Co., Flint.
R. D. Harrison, III, Gen. Foreman, Saginaw Malleable Iron Div., G.M.C., Saginaw.
John J. Hayes, Foreman, Chevrolet Grey Iron Foundry, Saginaw.
George Koehn, Ass't. Gen Foreman, Saginaw Malleable Iron Div., G.M.C., Saginaw.
W. F. Marande, Met., Eaton Mfg. Co., Saginaw.
Stuart D. Martin, Production Mgr., Saginaw Malleable Iron Div., G.M.C., Saginaw.
Clarence W. Meyer, Foreman, Saginaw Malleable Iron Div., G.M.C., Saginaw.
Frederick P. Strieter, Met. Engr., Dow Chemical Co., Midland.

## SOUTHERN CALIFORNIA CHAPTER

***Aluminum Casting Co., Los Angeles (Walter Vals).**
Dwight C. Cooley, Paul G. Wagner Co., Los Angeles.
Harry A. Graham, Personnel Mgr., Los Angeles Steel Casting Co., Los Angeles.
***Mueller Company, Los Angeles (Roy Thomas).**
Edward D. Page, Foundry Foreman, Rich Mfg. Co., Los Angeles.
R. L. Petersen, Sales Engr., The Permanente Metals Corp., Permanente, Calif.
James R. Reeves, Lead Man, Rich Mfg. Co., Los Angeles.
Joseph B. Tipton, Foreman, Los Angeles Steel Casting Co., Los Angeles.
Anthony Tuzzolino, Kinney Aluminum Co., Los Angeles.

## TEXAS CHAPTER

John M. Bird, Owner, American Brass Foundry, Fort Worth.
R. J. Evans, Heat Treat. Opr., Aircraft Foundry & Pattern Co., Grand Prairie.
James Thompson, Foundry Foreman, Dedman Foundry & Machine Co., Houston.
***Wichita Falls Foundry & Machine Co., Wichita Falls, Texas (Byron Adams, Foundry Sup't.).**

## TWIN-CITY CHAPTER

Robert H. Lundquist, Supv.-Met. Lab., Minneapolis-Moline Power Implement Co., Minneapolis.

## WESTERN MICHIGAN CHAPTER

W. E. Armstead, Office Mgr., Standard Foundry, Inc., Cadillac, Mich.
L. O. Greelye, Engr., Standard Foundry, Inc., Cadillac.
Paul Kline, Shop Sup't., Standard Foundry, Inc., Cadillac.
R. W. Ransom, Sales Mgr., Standard Foundry, Inc., Cadillac.
***Standard Foundry, Inc., Cadillac (Floyd J. McCarthy, Pres.).**

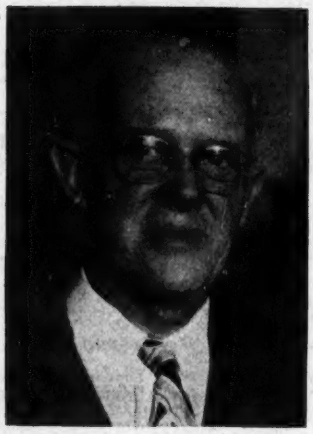
## WISCONSIN CHAPTER

Leonard A. Bayer, Nordberg Mfg. Co., Milwaukee.
John L. Hoffman, Chief Clerk, Allis-Chalmers Mfg. Co., West Allis.
Edward J. Lenz, Sales Mgr., Swan-Finch Oil Corp., Milwaukee.
Stanley H. Olson, Prod. Supv., Pelton Steel Casting Co., Milwaukee.
Paul G. Thessin, Sales, Pelton Steel Casting Co., Milwaukee.

## OUTSIDE OF CHAPTER

Clyde Achtzehn, Ass't. Core Room Foreman, Fort Pitt Steel Casting Co., McKeesport, Pa.
D. E. B. Barnard, Dir., Messrs. Barnard & Sons, Ltd., Barking, Essex, England.
***Cinoca S. A., Montevideo, Uruguay.**
Joseph A. Duma, Met., Foundry, Norfolk Navy Yard, Portsmouth, Va.
***D. P. Fisher, Ltd., Wellington, New Zealand (T. A. Fisher, Dir.).**
J. Mauger, Core Room Foreman, Fort Pitt Steel Casting Co., McKeesport, Pa.
W. L. Sturgeon, Allied Argentina S. A., Buenos Aires, Argentina, S. A.
Jordao Vecchiatti, Ass't. Chief Engr., Laminacao Nacional De Metals, Sao Paulo, Brazil.

# Wm. G. Mixer Honored By Stevens Institute



W. G. Mixer

WILLIAM G. MIXER, Foundry Superintendent, Buick Motor Div., General Motors Corp., Flint, Mich., has been awarded the Medal of Honor by his alma mater, Stevens Institute of Technology, Hoboken, N. J.

Mr. Mixer was one of seven alumni chosen for the first award of this honor. The recognition was given for the excellent work which he has done in designing and operating the aluminum foundry of the Buick Motor Div.

Mr. Mixer is a member of A.F.A. and of the Saginaw Valley Group, Detroit Chapter. He is one of the backers of the group and encourages his men to attend and participate in the meetings and activities of the chapter. We know all members of the Association join with the members of the Saginaw Valley Group and his many friends in congratulating Bill on the honor which he has so justly received.

# Report on the Cupola Research Handbook

By R. G. McElwee
**Chairman, Cupola Research Committee**

SINCE the last meeting of the steering committee there has been an apparent disposition on the part of all of those responsible for the publication of the book to get their material into the hands of the national staff for final arrangement.

As is the case in all matters of this kind we have gone through a series of discussions and rationalization, leading first to the formation of the plan, then to a co-relation of ideas and eventually to a certain amount of rewriting and plugging of holes.

It must be remembered that this is an entirely new presentation and that the pattern itself had to be developed. Most of the manuscripts are in, or in the final stages of dressing up.

There is a considerable amount of work of arrangement, indexing, etc., which has to be done, but it is now in hands familiar with that type of work and should be ready for issue and mailing in the Fall of 1945.

# Non-Ferrous Society Approves Pattern Colors

YOUR Association has been notified that at a meeting of the Non-Ferrous Founders' Society, held in Columbus, Ohio, October 27-28, that organization officially approved the standard pattern colors originated by the Joint Committee on Pattern Equipment Standardization, sponsored by your Association and consisting of official representatives of various national organizations.

The standard has been approved as American Tentative Standard B-45, 1-1932 by the American Standards Association; as Commercial Standard CS 19-30 by the U. S. Department of Commerce, Bureau of Standards; and by the following technical, business and trade associations in addition to the Non-Ferrous Founders' Society:

Malleable Founders' Society, American Institute of Mining and Metallurgical Engineers, American Society for Testing Materials, National Association of Pattern Manufacturers, National Association of Purchasing Agents, Foundry Equipment Manufacturers' Association, Steel Founders' Society of America, Gray Iron Founders' Society.

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**Director**
**Toledo Chapter**

**Walter J. Temple**
Kincaid-Osborn Electric Co., Inc.
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**C. E. Silver**
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**Detroit Chapter**

**F. K. Brown**
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**Secretary-Treasurer**
**Birmingham District Chapter**

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Saginaw Malleable Iron Div.
General Motors Corp.
Saginaw, Mich.
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**Newfoundland Chapter**

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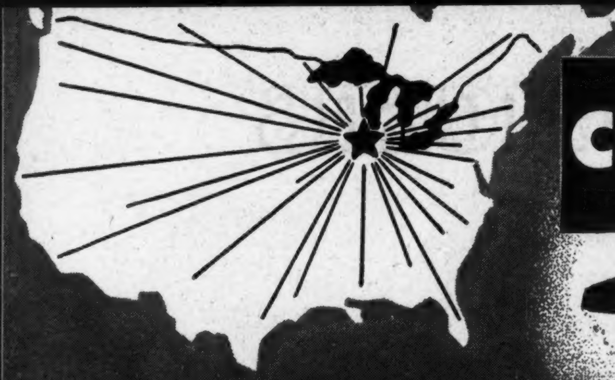


# CHAPTER ACTIVITIES News

*See page 31 for list of Chapter representatives whose reports of local activities appear in this issue.*

## PITTSBURGH ASSOCIATION
### *Hears J. S. Vanick Discuss Cast Iron*

THE January meeting of the Pittsburgh Foundrymen's Association, held January 15 at the Fort Pitt Hotel, Pittsburgh, was addressed by J. S. Vanick, metallurgist, International Nickel Co., New York, on "New Horizons for Cast Irons." He divided his talk into four sections, dealing specifically with Strength; Heat Treatment; Inoculation, Structure Control, Machinability and Wear Resistance; and Heat Resistance.

Mr. Vanick pointed out that by now all foundrymen are skilled in producing any tensile strength over the range of 20,000 to 60,000 psi. He illustrated the progress which has been made in permitting the foundry to standardize upon a single mixture for the higher strength grades by making one containing approximately 3.00 per cent total carbon and 1.50 per cent silicon, and successively alloying this to produce A.S.T.M. 40, 50 and 60 grades of cast iron.

According to the speaker, new horizons for cast iron exist in the opportunity to develop the production of iron with a low total carbon content which, by inoculation and alloying, develop tensile strengths of 60,000, 70,000, 80,000 and close to 100,000 psi. A product of this kind follows closely the theory outlined in an A.F.A. paper by Flinn and Reese,* and requires close control over cupola practice, including metal and fuel charges, handling of alloys, tapping, etc.

All alloys are charged in the cupola, except for final adjustments at the ladle to achieve the desired tensile strength level and compensate for differences in casting section. Castings then are subjected to an anneal at 600° F. to develop maximum properties. New horizons for cast irons of this type include locomotive and diesel castings, crankshafts, dies, heavy machinery.

Reference was made to the available information on heat treatment in the CAST METALS HANDBOOK and the ALLOY CAST IRONS HANDBOOK, published by A.F.A. It was pointed out that quenching and tempering are used mainly to produce a high hardness for resisting wear, or a high strength for heavily

*Flinn, R. A. and Reese, D. J., "*The Development and Control of Engineering Gray Cast Irons*," TRANSACTIONS, A.F.A., vol. 49, pp. 559-607, 1941.

**An enrollment of almost 600 set a new attendance record at the 8th Regional Meeting, sponsored jointly by the Wisconsin Chapter and the University of Wisconsin at the Schroeder Hotel, Milwaukee, February 8-9.**

*(Photos courtesy John Bing, A. P. Green Fire Brick Co.)*

stressed castings. Since high strength can be readily produced without special heat treatment, most of these activities are concerned with the production of high hardness.

An important new application of heat treatment is for the very close control of the high strength properties of thin-sectioned castings, such as piston rings, pistons and similar products. While these products may be developed in a high strength "as cast" iron they must frequently be heat treated to keep their properties within a 5,000 psi. range with tensile strengths as selected within the bracket of 60,000-80,000 psi.

After practically all possible refinements are applied to melting and pouring methods, it becomes necessary, in some cases, to heat treat these castings by air cooling from a high temperature, followed by tempering and again air cooling to develop the properties specifically required. The practice is applicable mainly where a large volume of repetitive work is in process. New horizons for gray iron castings prepared in this way exist for such parts as piston rings, pistons and similar applications where light weight combined with high strength are needed.

Inoculants were described as complex alloys containing silicon and deoxidizers which, in the best examples, achieved control over the structure and produced more uniform properties. A successful inoculant permits the foundryman to apply a single cupola mixture over a wider range of castings without fear of encountering difficulties from super-cooling, super-heating, tramp elements, chill, gas and similar factors which normally required extremely close control.

It was predicted that the time is not far off when all important castings for machinability or wear resistance, regardless of their basic composition, will be treated with inoculants at the ladle to produce an assured structure, and that further improvements to strength, hardness, wear, heat and corrosion resistance, will be provided with the addition of the usual alloys.

The latest edition of the ALLOY CAST IRONS HANDBOOK describes some of the available materials. Typical illustrations of poor and good structures were shown, and typical castings such as machine tools, gears, dies, engine cylinders, etc., were mentioned as candidates for inoculation treatment, which would extend the serviceability of these products.

View of the Speakers' Table at a recent Quad City meeting, when A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee, Wis., discussed pattern making. Shown, left to right, are: Chapter Vice-Chairman E. D. von Luhrte, Chicago Retort & Fire Brick Co., Davenport, Iowa; A. F. Pfeiffer, the speaker; Chairman R. E. Wilke, Deere & Co., Moline, Ill.; Major Frank W. Ashton, U. S. Engineers; C. H. Burgston, Program Chairman, and A. F. Burleigh, U. S. Engineers.

This topic of heat resistance was divided into two sections, the first describing the movement to permit cast iron to be used for pressure vessel applications for temperatures up to 650° F. instead of the prevailing limit of 450° F. War conditions led to the assignment of a study of this problem by A.S.T.M. and A.F.A. committees.

The 450° F. maximum limit, which has prevailed for over 30 years, was recommended increased to 650° F. for cast irons possessing a strength exceeding 40,000 psi. This includes irons of the A.S.T.M. 40, 50 and 60 types. Details of the composition and specification limits were outlined.

In the high temperature range, the skill which foundrymen have acquired in the control of their products points to the possibility that for temperatures up to 1400° F., cast irons containing chromium contents up to 2.00 per cent may become more common when this chromium maximum is combined with other alloying elements to maintain gray iron structures of high strength with a high resistance to thermal shock.

These castings will sacrifice machinability because the gray iron structure will be comparatively hard. Many common applications of furnace parts, grate bars, coke oven castings, etc., may be eligible for improvement with this type of material.

For temperatures up to 1600° F., at which extremely rapid scaling rates occur, a new alloy of nickel-chromium-silicon type has been developed which retains its toughness both cold and hot. This alloy contains approximately 30 per cent nickel, 6 per cent chromium and 6 per cent silicon. In the 1600° F. temperature range, all cast irons, including other high alloy types, are rapidly oxidized and destroyed. These heat resisting cast irons again are opening new horizons for the foundryman's product, which will enable him to compete successfully with other applicable materials.

## First National Officers' Night at Saginaw Valley

By Jos. J. Clark

THE Saginaw Valley Group celebrated National Officer's Night with a dinner meeting held at the Fischer Hotel, Frankenmuth, Michigan, March 1. Fred J. Walls, International Nickel Co., Detroit, National Vice-President, and Norman F. Hindle, Director of the A.F.A. Technical Development Program, were guests of honor.

Another honored guest of the evening was Wm. G. Mixer, Buick Motor Div., who was introduced to the group by Mr. Walls. Mr. Mixer is one of nine distinguished men who recently received an honor award presented by the Alumni Association of Stevens Institute of Technology, of which Mr. Mixer is a 1909 graduate.

J. A. Gitzen, Delta Oil Co., Milwaukee, then discussed "Physical and Chemical Properties of Core Binders, Core Washes and Their Reaction in Contact with Molten

Metals." He approached his subject by describing the early types of core binders used in the foundry and pointed out the good and bad characteristics of each. Among those discussed were wood resins, petroleum pitch, and linseed oil. With these as a starting point, he discussed why and how the modern blended core oil came into existence.

The speaker next dealt with the dry binders such as the cereal binders made with grains. While corn flour had become most popular, possibly because of high green strength, Mr. Gitzen stated that much work was being done on the processing of other grains such as wheat and barley. Other dry binders which were mentioned were red oxide and the clays, such as bentonite.

In speaking of core complaints, it was stated that the majority of them could be traced to insufficient baking of the core. In connection with core practices, Mr. Gitzen told the group of some interesting work on baking cores in a matter of minutes rather than hours, by drawing air through the core and speeding oxidation. A lively question and answer period completed the evening.

## Chesapeake Membership Reaches Total of 225

By E. J. Hubbard

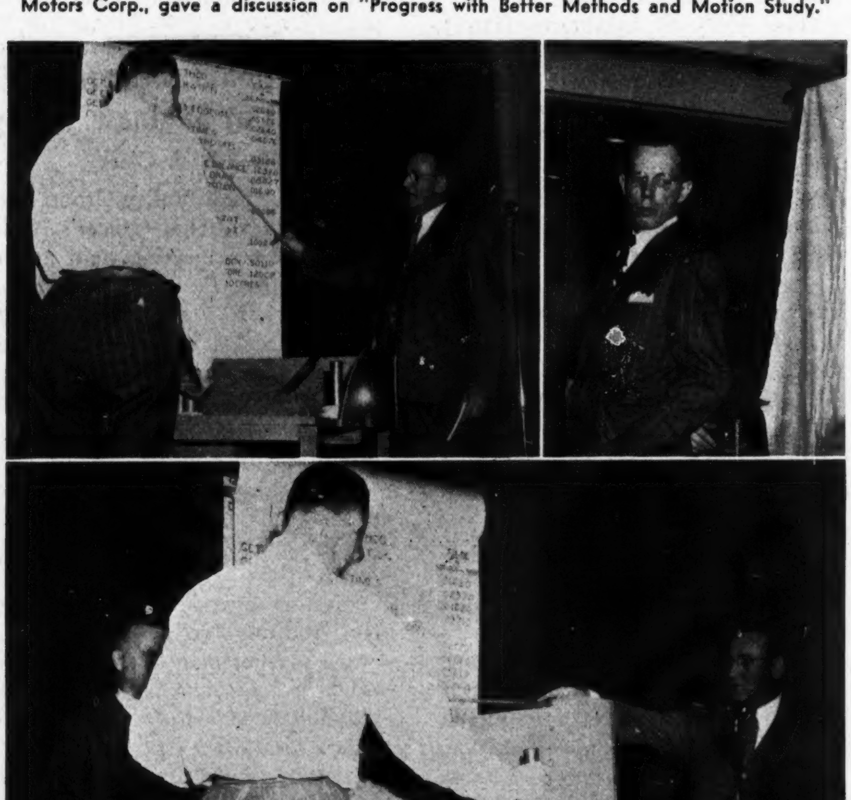
CHESAPEAKE Chapter held its annual session on brass and bronze February 23 at the Engineers Club, Baltimore. The speaker of the evening was W. J. Laird, Westinghouse Electric & Manufacturing Co., East Pittsburgh, whose subject covered investigations on "The Relation of Strength to Section in Sand-Cast Brass and Bronze."

Mr. Laird discussed experiments conducted by his company on silicon-bronzes, Navy brass, high-strength brass, Navy "G" brass, phosphorus bronze and the effects of section size of these materials, when cast under proper conditions, on the strength; also the corresponding results obtained using standard sand-cast test bars.

Dr. B. M. Loring, Naval Research Laboratory, Anacostia, D. C., added paralleling information covering work now under investigation at the Naval Research Laboratory.

An announcement of real interest was made by Chapter Chairman H. A. Horner, Frick Co., Waynesboro, Pa., when he stated that the membership of the chapter had now reached a total of 225 members.

**Over 300 members and guests were on hand at the February 5 meeting of the Chicago Chapter, when Jas. H. Smith and Stuart D. Martin, Saginaw Malleable Iron Div., General Motors Corp., gave a discussion on "Progress with Better Methods and Motion Study."**



## Frank Kiper Speaks At Twin City Meeting

By Alexis Caswell

FRANK KIPER, Ohio Steel Foundry Co., Springfield, Ohio, was the featured speaker at the regular meeting of the Twin City Chapter, held at the Curtis Hotel, Minneapolis, February 20, with Vice-Chairman R. C. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, presiding.

Mr. Kiper went into great detail in presenting "Cast Steel Breech Rings for Guns," and the discussion which followed brought out additional phases of the subject.

Door prizes were presented by Axel F. Carlstrom, Smith-Sharpe Co., Minneapolis, as Chairman of the Door Prize Committee. New members were introduced by A. A. Gustafson, E. F. Houghton & Co., St. Paul, of the Membership Committee. Approximately 107 members and guests were present at this meeting which concluded with the showing of a sound film entitled "Men of Fire."

## Round Table Meeting Held at E. Canada

By G. Ewing Tait

GROUP discussions on "Molding Practice, Gates and Risers"' were featured at the February 16 meeting of the Eastern Canada and Newfoundland Chapter, held in the Mount Royal Hotel, Montreal. As usual the groups attracted a large number of foundrymen anxious to air their views.

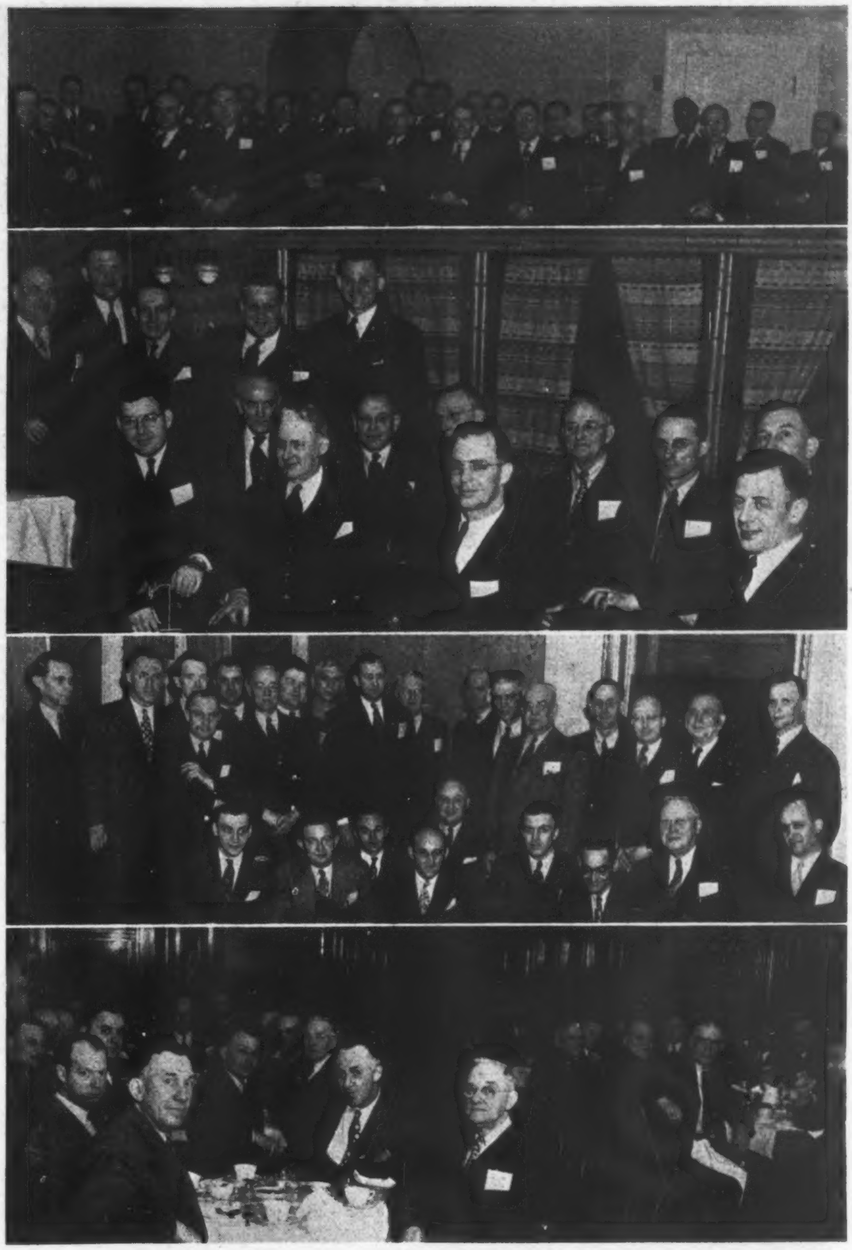
The cast iron group was presided over by G. D. Turnbull, Canadian Car & Foundry, Ltd., Montreal. Discussion leaders were Wm. Bradley, Dominion Engineering Works,

Ltd., Montreal, who spoke on molding sands, and John McCallum, Canadian Car & Foundry Co., Ltd., who outlined the relationship between pouring temperatures and sound castings.

W. L. Bond, Ottawa Car & Aircraft, Ltd., Ottawa, and E. G. Jennings, Dominion Engineering Works, Lachine, Que., outlined successful methods used in the production of some complicated bronze valve castings. Pressure pouring without risers was emphasized, although the use of different types of risers and chills was discussed at great length.

The steel group was presided over by Ernest Tyler, Canadian Car & Foundry Co., Ltd. Discussion was largely centered around the use of special risers, such as the William's head, Washburn core and graphite rods. Preliminary talks were given by Charles V. Hacker, Hull Iron & Steel Foundries, Ltd., Hull, Que., and Robert Hale, Canadian Car & Foundry Co., Ltd.

The chairman of the Educational Committee, Henry Louette, Warden King, Ltd., Montreal, spoke briefly on the lecture course which was to start the following week, and mentioned the large number of registrations which had been made. He expected an attendance of 125 to 150.



The February 15 Round Table Meeting of the Canton Chapter, held at the Elks' Club, Alliance, Ohio, drew a fine crowd. Different sessions were (top to bottom): Cast Iron, Non-Ferrous, Steel, and a section of the dinner group.

## Central New York Resumes Meetings

By J. A. Feola

AFTER a recess of one month, due to the ban on public gatherings in the area, the Central New York Chapter resumed its activities March 9 at the Onondaga Hotel, Syracuse.

Chapter Chairman L. E. Hall, Syracuse Chilled Plow Co., Inc., Syracuse, N. Y., presided and introduced T. E. Barlow, Battelle Memorial Institute, Columbus, to the 70-odd members and guests present. Mr. Barlow's subject was "Gray Iron Structure."

The speaker began by describing the difference in ladle additions for alloying and those for structure control. He stated that elements added to the ladle for alloying purposes are present in the chemical analysis, while those added for structure control are not apparent. There are two types of inoculants—graphitizing and stabilizing. The type to use depends on the analysis of the iron and results desired. This can be determined only by experimentation for each particular foundry.

Mr. Barlow presented a series of slide charts and pictures to prove the benefits of ladle inoculations, for irons of various compositions, in regard to tensile strength, Brinell hardness, grain size, etc. After his talk, the speaker opened the meeting for a discussion period.

Following the formal meeting and discussion period, refreshments were served and the group split up into a number of smaller groups where foundry problems and experiences were exchanged. This was the first time such a procedure was tried at Central New York and there was little doubt about its popularity.

## Round Table Sessions Highlight Chicago Meeting

APPROXIMATELY 175 members and guests were present at the Chicago Chapter Round Table Meeting, held at the Chicago Bar Association Restaurant, Chicago, March 5, with Chairman A. S. Klopf, Firegan Sales Co., Chicago,

*(Photos courtesy John Bing, A. P. Green Fire Brick Co.)*
**More candid camera studies of the personalities at the Wisconsin Chapter's 8th Regional Conference.**

presiding over the general session.

Vice-Chairman J. C. Gore, Werner G. Smith Co., Div. Archer-Daniels-Midland Co., Chicago, announced the meeting rooms and introduced the speakers and chairmen for the round table sessions, as follows:

*Steel Division Meeting Combined With Pattern Division*—Speaker, Lave G. Gustafson, Continental Foundry & Machine Co., East Chicago, Ind; Chairman, Martin Rintz, Continental Foundry & Machine Co.

*Gray Iron Division*—Speaker, A. J. Edgar, Gray Iron Society, Inc., Washington, D. C.; Chairman, L. A. Colangelo, International Harvester Co., Tractor Works, Chicago.

*Non-Ferrous Division*—Speaker, Oscar Blohm, Hills-McCanna Co., Chicago; Chairman, R. F. Thomson, Dodge Chicago Plant, Chrysler Corp., Chicago.

*Malleable Division*—Speaker, Norman Tisdale, Molybdenum Corporation of America, Pittsburgh; Chairman, W. D. McMillan, International Harvester Company, McCormick Works, Chicago.

Prior to the adjournment to the round table meeting rooms, Chairman Klopf appointed H. A. Forsberg, Continental Foundry & Machine Co., East Chicago, Ind.; A. W. Gregg, Whiting Corp., Harvey, Ill., and W. D. McMillan, International Harvester Co., McCormick Works, as a nominating committee for selecting nominees for the offices of the Chicago Chapter for 1945-46.

## Inspection Methods Is St. Louis Topic

**By Chas. E. Rothweiler**

EIGHTY-FIVE members and guests were present at the March 8 meeting of the St. Louis District Chapter to hear C. F. Rohlkoetter, American Steel Foundries, East St. Louis, Ill.

In his subject, "Inspection of Steel Castings," Mr. Rohlkoetter brought out that there was much to be desired in working out a satisfactory method of inspection but, he added, that X-ray and radiography have been very helpful. Because some of their castings are used at temperatures below zero, such castings are being inspected at the subzero and room temperatures. Considerable discussion followed the talk.

## Inspection Tour Opens Northeastern Ohio Meeting

**By Edwin Bremer**

ONE of the best turnouts of the season marked the March 8 meeting of the Northeastern Ohio Chapter at the Cleveland Club. It began with an open-house inspection of the training facilities of the Cleveland Trade School in the afternoon which was attended by a large group of foundrymen and vocational school directors and instructors from other schools in the district.

The latter were dinner guests of the chapter, and heard brief talks by J. H. Redhead, Lake City Malleable Co., Cleveland, and D. C. Courtright, Cleveland Trade School. Mr. Redhead spoke on "The Foundry Offers an Opportunity to Youth," pointing out the importance of the industry in relation to every day life as well as in war, and the advantages it offers to youth of vision.

Mr. Courtright talked on "Training Youth for Foundry Opportunity"

and described the vocational arts system in Cleveland where the boys are given exploratory courses beginning in the junior high schools. In the technical high schools they are given opportunity to specialize. In the trade or vocational school the boys are given 2-year courses in foundry and patternmaking in which they spend half the time on shop practice and related work, and half the time on mathematics, English and similar work. Then they are placed in industry, and return to school on a part-time basis for two years. At the end of that time, on completion of the required work, they are granted diplomas.

Principal speaker at the technical session was C. E. Westover, Grede Foundries, Inc., Milwaukee, who discussed "Wage Incentive in the Foundry." He stated that labor is the largest single item in the cost of castings, and reaches the proportions of equalling the sum of all the other costs combined. Hence, accurate relationship between labor cost and productivity should be determined.

According to the speaker, wage incentive is a plan wherein the value placed on performing a given piece of work is expressed in a time study standard. Basic measure in that plan is time, a stable measure for worker, production, equipment, materials, methods and planning.

## Round Table Groups Meet at Central Ohio

By Frank Kiper

FOLLOWING a general session at the Fort Hayes Hotel, Columbus, on February 26, members and guests of the Central Ohio Chapter formed two round table sessions, one on steel and the other on iron.

The steel group was addressed by J. B. Caine, Sawbrook Steel Castings Co., Lockland, Ohio. Mr. Caine presented his paper entitled "Why Heat Treat?" in which he brought out many thought provoking questions. This paper was quite timely on account of the rigid specifications which steel foundries will be expected to meet if they are to continue a maximum rate of production in competition with other industries.

Arthur Klopf, Firegan Sales Co., Chicago, was the principal speaker


Block and Gavel presented to Oregon by the Northern California Chapter. Made of Lignum Vitae, the original model was fashioned by the late John Healy, and presented to Northern California in 1936. This copy was made in the pattern shop of Charles Hoehn, Jr., Enterprise Engine & Foundry Co., San Francisco, from a chopping block that had been in the possession of Geo. L. Kennard, Northern California Foundrymen's Institute, Secretary-Treasurer of Northern California for 25 years.

at the iron session, and he presented a preview of the forthcoming A.F.A. book on casting defects. Mr. Klopf reviewed the work of the Committee on Casting Defects, and emphasized that the work of the group is not to tell foundrymen who is to blame for various casting defects, but rather to present the recognized causes for various defects. Numerous slides of casting defects were shown, and considerable interest was evinced in the conditions causing defects and the means to their elimination.

## Oregon Holds First Organized Meeting

THE Oregon Chapter, the "baby" chapter of A.F.A. held its first meeting at the Heathman Hotel, Portland, on February 23. Over 80 members and guests were present at the dinner, over which W. R. Pindell, Northwest Foundry & Furnace Works, Portland, presided as Chairman of the Organization Committee.

To start off the Chapter, R. E. Kennedy, National Secretary, was present and gave a short talk on the objectives and work of the Association. During his talk, Secretary Kennedy turned over to Chairman Pindell the famous "traveling cast iron baby chapter rattle." This rattle is to be retained by the Oregon group until a subsequent chapter is organized.

Following Secretary Kennedy, Charles Hoehn, Jr., Enterprise Engine and Foundry Co., San Francisco, a past chairman of the Northern California Chapter, and past national director of A.F.A., presented to Chairman Pindell, on behalf of the Northern California Chapter, a gavel in the form of a molder's bench rammer and flask. Replicas of this gavel were made by Mr. Hoehn and presented to the Northern California Chapter on its organization, and this Chapter, in turn, also presented one to the Southern California Chapter on its organization.

The Oregon Chapter starts out with an excellent roster, with members from practically every foundry in the immediate Portland area. The Association extends to this youngster its best wishes, and realizes that the Chapter will go far toward consolidating the technical interest of the foundry industry on the Northwest Coast.

## National Officers Night For Central Indiana

By Robert Langsenkamp

APPROXIMATELY 95 members and guests were present to hear the two speakers featured on the National Officers Night program of the Central Indiana Chapter, held March 5, at the Athenaeum, Indianapolis.

Carl Zapffe, Rustless Iron & Steel Co., Baltimore, spoke on the subject of "Porosity in Steel and Cast Iron," while M. E. Brooks, Bay City Div., Dow Chemical Co., Bay City, Mich., discussed "Magnesium Casting Methods."

Special guests were Fred J. Walls, International Nickel Co., Detroit, National Vice-President, and N. F. Hindle, Director, A.F.A. Technical Development Program.

Mr. Walls stated that elementary foundry courses should be given in junior high schools. If a sufficient

number of boys and young men demand further education in foundry rudiments, high schools and colleges which at present lack such courses, will be forced to include them in their curricula.

Mr. Hindle met with the local directors, prior to the technical session, to determine the best procedure for an educational program to be sponsored by the local chapter.

Chapter Chairman H. H. Lurie, Cummins Engine Co., Columbus, Ind., who presided at the meeting, announced the nominating committee which will select nominees for the officers and directors to serve in the new term.

## J. W. Juppenlatz Is Philadelphia Speaker

By B. A. Miller

JOHN JUPPENLATZ, Lebanon Steel Foundry, Lebanon, Pa., was the speaker and Philip G. De Huff, Jr., Westinghouse Electric & Mfg. Co., Philadelphia, was the Technical Chairman at the Philadelphia Chapter meeting, held February 9 at the Engineers' Club.

Approximately 75 members and guests were present to hear Mr. Juppenlatz describe the various methods for non-destructive testing of castings. The speaker used equipment to demonstrate how effectively surface defects can be determined when castings have been properly treated.

He warned that, with all the various testing equipment, it will be necessary for foundrymen to produce better castings in order to meet the rigid inspection methods now being employed.

## J. A. Gitzen Speaks At Ontario Meeting

By G. L. White

"CORES, Core Binders and Core Washes" was the subject of an address by J. A. Gitzen, Delta Oil Products Co., Milwaukee, at the Ontario Chapter meeting, January 26, at the Royal Connaught Hotel, Hamilton.

The speaker pointed out that the sand used in cores exerted an influence upon the binders and washes employed. There are a multitude of types of sand used, and most foundries use local sand when possible, but many plants must bring some or all core sand from distant points.

Core binders may be divided into two principal classifications: (1) organic binders which are destroyed by temperatures up to 1000° F.; (2) inorganic binders which are not destroyed and develop their properties at high temperatures.

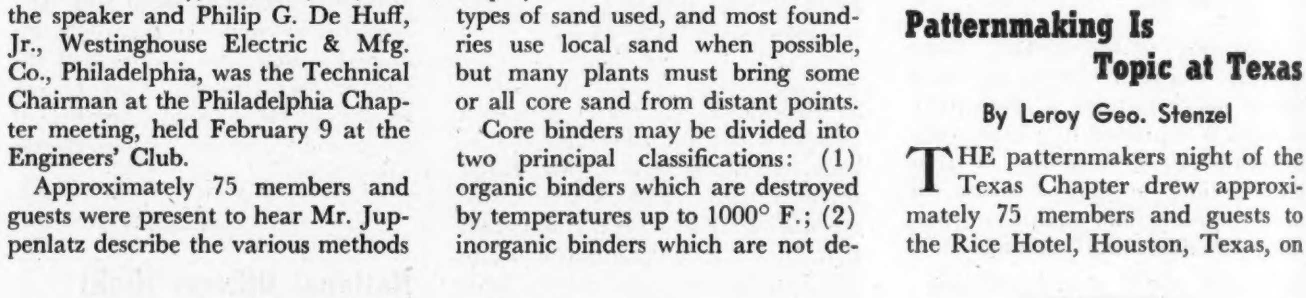
The speaker also discussed washes and facings, defining a wash as an inert seal for a core to prevent leakage of gas. In gray iron work, facings of linseed oil mixed with dry sand have been used.

The National Board of A.F.A. was represented at this meeting by Directors R. T. Rycroft, Jewell Alloy & Malleable Co., Inc., Buffalo, and Joseph Sully, Sully Brass Foundry, Ltd., Toronto. Mr. Rycroft spoke briefly on the technical development program of A.F.A., for which everyone connected with the organization has high hopes. Mr. Sully made particular reference to the value of sustaining membership in helping to support the technical development program. He also referred to the cancellation of the Foundry Congress and the steps being taken by A.F.A. to provide alternate activities.

## Patternmaking Is Topic at Texas

By Leroy Geo. Stenzel

THE patternmakers night of the Texas Chapter drew approximately 75 members and guests to the Rice Hotel, Houston, Texas, on



J. A. Gitzen, Delta Oil Products Co., was the principal speaker at the Saginaw Valley Group's March 1st meeting at the Fischer Hotel, Frankenmuth, Mich. Photos show a view of the Speakers' Table and a section of the general group.

February 8, to hear E. T. Kindt, Kindt-Collins Co., Cleveland.

Mr. Kindt, in his talk on the history and future of patternmaking, suggested that patternmakers should strive to be more alert to the possibilities in using new materials and new machines. According to statistics cited by the speaker, there is one patternmaker per hundred thousand population in the United States, and the pattern shops are slow in creating craftsmen.

The speaker used movies to illustrate the use of modern equipment and the production of modern patterns at the Motor Pattern Works and the Scientific Cast Products Co., both of Cleveland.

Chapter Chairman F. M. Wittlinger, Texas Electric Steel Casting Corp., Houston, presided at the meeting.

## National Officers' Night At Western Michigan

**By C. H. Cousineau**

FEBRUARY 12 was National Officers' Night for the Western Michigan Chapter, at a meeting held at the Hotel Ferry, Grand Haven, Michigan. Approximately 85 members and guests were present to welcome R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., the National President of A.F.A., and N. F. Hindle, Director, A.F.A. Technical Development Program.

Mr. Teetor spoke on the need for dissemination of technical knowledge, the keen competition which the foundry industry can expect after the war, and of plans for the improvement of the AMERICAN FOUNDRYMAN.

Mr. Hindle spoke on the plans to enlarge the technical services of A.F.A. These included the publishing of handbooks on such subjects as Molding Sand, Cupola Operation and Solidification and Design. He also told of plans to establish a technical library which would feature bibliography and abstract service to members.

The technical speaker of the evening was M. R. Scott, Linde Air Products Co., Detroit, who discussed "Flame Cutting, Flame Gouging and Oxyacetylene Cutting as Practiced in Steel Foundries."

## Northern California Holds Joint Meeting With A.S.M.

**By Richard Vosbrink**

VICTOR P. BEAUCHAMP, Chairman of the Golden Gate Chapter of the American Society for Metals, presided and shared honors with R. C. Noah, San Francisco Iron Foundry, President of the Northern California Chapter, at the joint meeting sponsored by the two organizations at the Engineers' Club, San Francisco, February 19.

That part of the program assigned to A.F.A. was the introduction by National Director S. D. Russell, Phoenix Iron Works, Oakland, California, of the Chapter's guest of honor, Robert E. Kennedy, the National Secretary. Mr. Kennedy paid his respects to the American Society for Metals and to the officers and members of the Golden Gate Chapter.

The technical speaker of the evening, J. E. Wilson, Climax Molybdenum Co., used slides to illustrate points in his interesting discussion, "The Tensile Properties of Cast Steel."

## No. Ill.-So. Wis. Meets With Rock River Council

**By Howard W. Miner**

THE Northern Illinois-Southern Wisconsin Chapter took part in a meeting, sponsored by the Rock River Valley Engineering Council, held at the Hotel Faust, Rockford, Illinois, on February 19.

David Nichols, War Correspondent of the *Chicago Daily News,* just returned from Russia, gave a talk on Russia in which he brought out interesting facts that proved many current rumors, doubts and suspicions are without foundation. He said, also, that there is a strong likelihood of the Russian Government's return to capitalism as part of their economic structure.

### *Reports on Chapter Activities*

Officers and representatives of A.F.A. chapter and other foundry groups who report on local activities in this issue are identified below:

*Central Indiana*—Robert Langsenkamp, Langsenkamp-Wheeler Brass Works, Inc., Indianapolis; Chapter Secretary.

*Central New York*—John Feola, Crouse-Hinds Co., Syracuse, N. Y.; Chapter Reporter.

*Central Ohio*—Frank Kiper, Ohio Steel Foundry Co., Springfield, Ohio; Chapter Secretary.

*Chesapeake*—E. J. Hubbard, Koppers Co., Baltimore, Md.; Chapter Reporter.

*Eastern Canada and Newfoundland*—G. Ewing Tait, Dominion Engineering Works, Lachine, Que.; Chapter Vice-Chairman.

*Northern California*—Richard Vosbrink, Berkeley Pattern Works, Berkeley; Chapter Reporter.

*Northern Illinois-Southern Wisconsin*—Howard W. Miner, Fairbanks, Morse & Co., Beloit, Wis.; Chapter Secretary.

*Northeastern Ohio*—Edwin Bremer, THE FOUNDRY, Cleveland; Group Reporter.

*Ontario*—G. L. White, Westman Publications, Ltd., Toronto; Chapter Secretary-Treasurer.

*Philadelphia*—B. A. Miller, Cramp Brass & Ironu Founders Div., Baldwin Locomotive Works, Eddystone, Pa.; Chapter Director.

*Saginaw Valley*—J. J. Clark, Saginaw Malleable Iron Div., General Motors Corp., Saginaw, Mich.; Chapter Reporter.

*St. Louis*—C. E. Rothweiler, Hickman, Williams & Co., St. Louis; Chapter Secretary-Treasurer.

*Texas*—L. G. Stenzel, Stenzel Pattern Works, Houston; Chapter Reporter.

*Twin City*—Alexis Caswell, Manufacturers' Association of Minneapols, Inc., Minneapolis; Chapter Secretary-Treasurer.

*Western Michigan*—C. H. Cousineau, Western Michigan Steel Foundry Co., Muskegon, Mich.; Chapter Reporter.

# Schedule of April Chapter Meetings

**April 2**
**Central Indiana**
Athenaeum, Indianapolis
H. K. Nason
Monsanto Chemical Co.
*"Plastics vs. Metals"*

**Chicago**
Chicago Bar Ass'n Restaurant
David Nichol
*"Russia As I See It"*
General Meeting

**Metropolitan**
Essex House, Newark, N. J.
F. H. Hoult
Kent Alloys, Ltd., London
*"Production Technique Light Alloy Castings"*
A. Cristello
Bendix Aviation Corp.
*"Gating, Risering, Chilling Magnesium Sand Castings"*

**April 3**
**Michiana**
Hotel LaSalle, South Bend, Ind.
John M. Kane
American Air Filter Co.
*"Control of Dust in Foundries"*

**April 5**
**Saginaw Valley—Detroit**
Fischer Hotel, Frankenmuth, Mich.
A. Cristello
Bendix Aviation Corp.
*"Aluminum and Magnesium Foundry Practice"*

**April 6**
**Northern California**
Claremont Hotel, Berkeley, Calif.
L. D. Pridmore
International Molding Machine Co.
*"Core Blowing"*

**Ontario**
Royal Connaught Hotel, Hamilton
Round Table Meeting
Gray Iron, Steel, Malleable, Non-Ferrous

**April 7**
**Michiana**
Hotel Elkhart, Elkhart, Ind.
Ladies' Night

**April 9**
**Cincinnati**
Engineering Society Headquarters
Col. W. W. Rose
Gray Iron Founders Society

**Western Michigan**
Ferry Hotel, Grand Haven, Mich.
Jas. H. Smith & Stuart D. Martin
Saginaw Malleable Iron Div., General Motors Corp.
*"Progress with Better Methods and Motion Study"*

**April 10**
**Northern Illinois-Southern Wisconsin**
Hotel Hilton, Beloit, Wis.
Adrian Den Breejen
Hydro-Blast Corp.
*"Practical Foundry Sand Problems"*

**April 12**
**Northeastern Ohio**
Cleveland Club, Cleveland
W. C. Manwell
Fulton Foundry & Machine Co., Inc.
*"Patterns As the Jobbing Foundry Sees Them"*

**St. Louis**
De Soto Hotel, St. Louis
Cecil E. Bales
Ironton Fire Brick Co.

**Texas**
Lufkin Country Club, Lufkin, Texas
J. A. Gitzen
Delta Oil Products Co.
All Day Meeting

**April 13**
**Central New York**
Hotel Onondaga, Syracuse
W. A. Pennington
Carrier Corp.
*"Chemistry of Cupola Operation"*
National Officers' Night

**Oregon**
Heathman Hotel, Portland, Oregon
L. D. Pridmore
International Molding Machine Co.
*"Core Blowing"*

**Philadelphia**
Engineers Club, Philadelphia
Walter S. Giele
Walter S. Giele Co.
*"Mechanical Handling"*

**Rochester**
Seneca Hotel, Rochester
L. F. Tucker
City Pattern Works
*"Cooperation Between Patternmaker and Foundry"*

**Western New York**
Hotel Touraine, Buffalo
Thos. E. Barlow
Battelle Memorial Institute
*"Cupola Practice"*

**Wisconsin**
Schroeder Hotel, Milwaukee

**April 14**
**Chicago**
Stevens Hotel, Chicago
Annual Ladies' Night

**April 16**
**Quad City**
Ft. Armstrong Hotel, Rock Island, Ill.
A. S. Klopf
Firegan Sales Co.
*"Equipment and Pouring of Iron and Steel Castings"*
*"Casting Defects Analysis"*

**April 19**
**Detroit**
Rackham Educational Memorial
Round Table Meeting
Steel, Magnesium, Equipment

**April 20**
**Birmingham**
Tutwiler Hotel, Birmingham
E. H. Schleede
U. S. Gypsum Co.
*"Patterns of Gypsum Cement"* and *"Metal Casting in Plaster"*

**Canton**
Elks Club, Canton
National Officers' Night

**Eastern Canada and Newfoundland**
Mount Royal Hotel, Montreal
Round Table Meeting
Iron, Bronze, Steel

**April 23**
**Chesapeake**
Engineers Club, Baltimore
F. G. Sefing
International Nickel Co., Inc.
*"Study of Molding Methods for Sound Castings"*

**April 24**
**Toledo**
Toledo Yacht Club
C. F. Carson
National Supply Co.
*"Castings Design"*

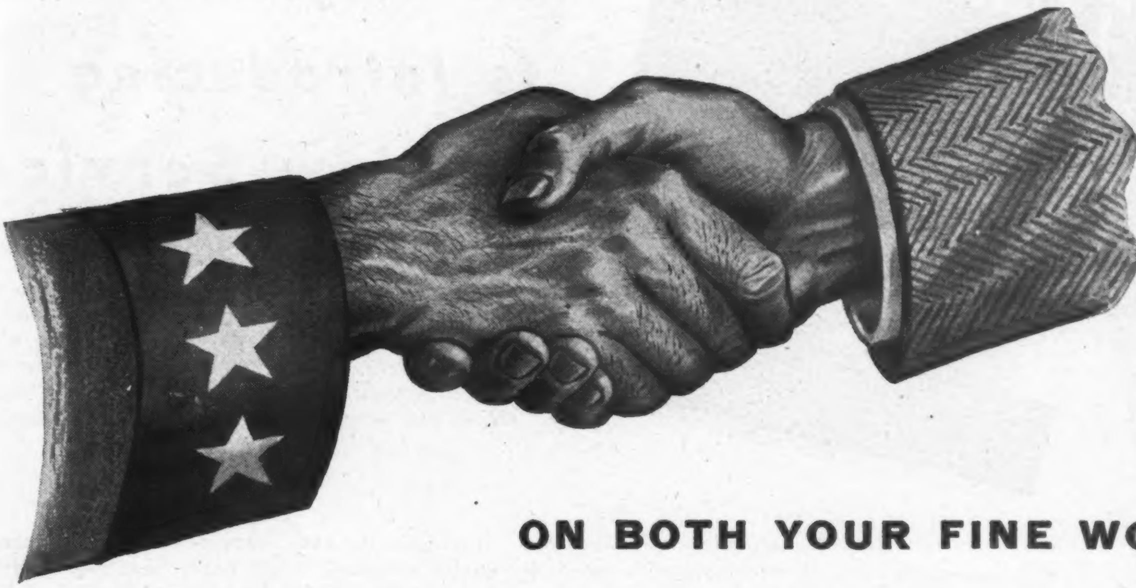
**Twin City**
Curtis Hotel, Minneapolis
E. H. Schleede
U. S. Gypsum Co.
*"Pattern Making"*

## MAY MEETINGS

**May 3**
**Saginaw Valley**
Fischer Hotel, Frankenmuth, Mich.
Jas. H. Smith
Saginaw Malleable Iron Div., General Motors Corp.
*"Progress with Better Methods and Motion Study"*

**May 6**
**Central Indiana**
Athenaeum, Indianapolis
*"Foundry Cost Systems"*

# CONGRATULATIONS...



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